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Emanuel Mendes da Costa (1717-91) and the *Conchology, or natural history of shells*

P. J. P. Whitehead

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Introduction

To earn a respected place in both the Society of Antiquaries and the Royal Society was not, in the eighteenth century, an uncommon achievement; but to be then expelled from the one and sent to prison by the other is altogether rare. Such was the fate of Emanuel Mendes da Costa (1717–91), 'that wayward Hebrew genius . . . whose scientific enthusiasm atoned for less honourable traits of character' (Fox, 1919 : 212). Da Costa has so far received only brief biographical treatment although, like many of his colleagues, he was an avid letter-writer and his carefully preserved correspondence (over two thousand letters) still survives. His life and career are here explored in connection with his authorship of the *Conchology, or natural history of shells*.

The true authorship of the *Conchology* – said to have been the first work in which this term was used (Dance, 1966 : 271) – has always been a puzzle since the book is undated and merely 'By a Collector'. Two possible authors have been suggested. The first is George Humphrey (? 1745–1825), collector and dealer in shells. Among those who have favoured his authorship have been Sherborn (1904) and Jackson (1937 : 333). The second possibility, more frequently cited, is da Costa and among those who put his name to the work were Schröter (1774 : 156), Chemnitz (1795 : 181, 184–8), Röding (1798 : 1–7), Maton & Racket (1804 : 200–1), and Iredale (1915 : 307 & 1922 : 86). Dillwyn (1817 : ix) settled for joint authorship and Swainson (1840a : 154) implied it, while Sherborn (1902 : xx, xxx) had initially been even more cautious and given the work under each of these two authors, but with a reference to possible authorship by the other. Dance (1966 : 271), who enjoyed such enigmas but never explored this one, opted for joint authorship.

In spite of this difference of opinion, no very convincing arguments have been offered. Certainly, Humphrey himself once claimed authorship, referring to the work as 'HUMPHREY'S Conchology' in his sale catalogue, the *Museum Humfredianum* (1779, 36th day). Da Costa, on the other hand, actually disclaimed authorship, giving the work as 'A new anonymous Conchology' (da Costa, 1776 : 51) or as merely the 'Anon. Conch.' (da Costa, 1778b : 1–24). However, there are reasons for believing that the statements of both Humphrey and da Costa are misleading.

The key to the mystery lies in the highly unusual circumstances that attended the production of the work, for it was during this time that da Costa fell into disgrace, being convicted of em-

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bezzlement and spending four years in prison. In itself, this merely suggests that anonymity is more consistent with da Costa's authorship than with Humphrey's. It does not explain what role Humphrey played and why he attached his name to it. The real solution to the puzzle, and a source that seems to have been overlooked by previous writers on the subject, can be found in the eleven volumes of da Costa's correspondence in the British Library.

On the basis of these da Costa letters, a number of which were written from prison during the critical period when the *Conchology* was being produced, together with hints in letters to other naturalists, the conclusion is reached here that the true author was da Costa and not Humphrey. The latter saw the work through the press and acted as editor, but it was actually written by da Costa as an unrepentant debtor in the King's Bench Prison.

Sources

The principal source for information on da Costa is the collection of his letters in eleven bound volumes in the Manuscript Department of the British Library. A note on the flysheet of the first volume states:

> This Collection, bound in Eleven Volumes, chiefly on Subjects of Natural history – addressed to Emanuel Mendes Da Costa, F.R.S. Author of a Natural History of Fossils, 4to 1757, with copies of his answers, in his own handwriting – from 1737 to 1787 – contains Two Thousand Four Hundred and Eighty seven Autographs. I purchased them from the late John Nichols, Author of the History of Leicestershire – who procured them from J & B White's Catalogue, Fleet Street – in exchange for other books.
> 1831 William Upcott

On a subsequent page is written 'Presented by the Rt. Hon. the Earl of Derby 8 Oct. 1870'.

This collection of letters is notable for its size, range of correspondents, variety of topics and frequent inclusion of drafts of da Costa's replies. No biographer could wish for better. Da Costa had a rather distinctive, angular, even childish hand and his drafts are easily read. Unfortunately, rather fewer letters date from the prison period (1768–72) and one gains the impression that many of his earlier correspondents fell silent when the blow fell.

The first to have this collection, Messrs J. & B. White, were the booksellers who, as B. White, had retailed the *Conchology* many years earlier. This was Benjamin White (1725–94), publisher at the 'Horace's Head' in Fleet Street, brother of Gilbert White and publisher of the first edition of 'Selborne'. White may have bought part or all of da Costa's library, possibly in 1787 when the letters cease.

There is no record of when the da Costa correspondence came to John Nichols (1745–1826), its next owner, but it apparently remained at the booksellers until at least 1812. Thus, in the third volume of Nichols' *Literary anecdotes* (1812b : 757) it is stated that 'Messrs. White and Cochrane possess in fifteen large portfolios, a very curious collection of letters to Mr da Costa from men of the first literary character of the time'. In the same year, Nichols published a genealogical manuscript of da Costa's family, drawn up by da Costa himself and also some 'brief memorials of contemporary Virtuosi' written by da Costa (Nichols, 1812a & b). Six years later Nichols had evidently acquired the da Costa letters, as noted in the Advertisement of volume 3 of his *Illustrations of literary history* (1818 : viii). In that and in subsequent volumes he printed a large number of letters to and from da Costa, as well as the 'brief memorials' where they were appropriate to the letters.

Nichols' library was sold at Sotheby's on 16–19 April 1828, but apparently it was not at that time that William Upcott (1779–1845) bought the da Costa letters (not in sale catalogue). Upcott, natural son of Ozias Humphrey and a passionate autograph hunter, died without issue and his huge collection of manuscripts, books, prints and drawings was sold at Sotheby's in June 1845 (priced catalogue, formerly owned by Dawson Turner, in the British Library). The da Costa letters were amongst several important lots which the British Museum declined to buy. Instead, they were bought by the Earl of Derby, to be presented to the British Museum in 1870.

Da Costa himself arranged his letters chronologically in 'large folio volumes of strong blue papers on which the Originals are pinned (not pasted) & uniformly bound'; at the time that da Costa wrote this (June 1782) there were eleven of these volumes (*fide* Add. Ms. 9389, f. 28). The correspondence to 1787 when the letters end must have occupied a further four volumes, making the fifteen bought by John Nichols. The letters are now alphabetically arranged, having presumably been rearranged and rebound by Upcott in 1831.

In addition to the main da Costa correspondence, the British Library manuscript catalogues give ten other da Costa items. There are seven letters to the Rev. Thomas Birch (Add. MS. 4303), a letter to Hans Sloane (Add. MS. 4439), an application for the post of Clerk to the Royal Society (Add. MS. 4441), da Costa's diploma from the Academiae Naturae Curiosorum (Add. MS. 6180), da Costa's catalogue of his library (Add. MS. 9389), a letter to him from Linnaeus (Add. MS. 23102, f. 123), da Costa's genealogy and notes on collectors, being those used by John Nichols (Add. MS. 29867), some historical notes on Jews (Add. MS. 29868), and his minutes from the Royal Society, 1757–62 (Eg. MS. 2381).

Another useful source for information on the *Conchology* and its author is the letter-book of his contemporary, the entomologist Dru Drury (1725–1804). Cockerell (1922) discovered this book, then owned by Messrs Power, Drury & Co, wine merchants of Funchal, Madeira, and he cited from thirty letters from Drury to Linnaeus, Moses Harris, Pallas and others, of which three to Peter Simon Pallas (1741–1811) are relevant here (12 November 1767, 28 February 1768 and 14 January 1770). These report da Costa's intention to publish natural history plates and they describe his subsequent disgrace. Parts of the second letter were also quoted by Iredale (1922). The letter-book was presented to the British Museum (Natural History) in 1937 by Charles Dru Drury, together with some other Drury papers and the latter's account book for the first two volumes of his *Illustrations of natural history* (Drury, 1770–83), which shows translation fees paid to da Costa. Sherborn (1937) reported this gift and indexed the recipients of the letters.

Pallas had met da Costa during his visit to England in 1761–62. Urness (1967) reproduced seventeen letters written by Pallas to Thomas Pennant (1726–98) in the period 1766 and 1777–81 and in two of these Pallas speaks of having seen da Costa's collection and admiring especially his Brazilian emeralds, specimens of which he later solicited but in vain. What would be of the greatest interest would be the main body of Pallas' letters since he corresponded as widely as did da Costa, but it does not seem to have survived. He did not leave his correspondence in Leningrad, apart from a few letters to him now in the Archives of the Academy of Sciences (none relevant here), and most probably he took all his papers with him when he retired to Berlin in 1810. There are a few letters in the Manuscript Department of the Staatsbibliothek at Dahlem (West Berlin). These include two from Pennant to Pallas (15 May 1753 and 26 November 1784 – see Sig. Darmst. Lc(1) 1771), four long and interesting letters from John Ledyard (1787 and 1788 – see Ms. Germ., f. 788), and six other letters (to Tilesius, to his mother-in-law and to four unknowns). Of equal importance is Pallas' day book for 1762–63 (Sig. Darmst. Asien (4) 1768) which contains, in German, French and English, Pallas' itineraries, the people he met, poems, anecdotes and book titles (with five pages devoted to some of the most salacious literature then purveyed by the Dutch bookshops!). There are references here to two letters and a parcel (of amber) sent to da Costa (14 October and 28 November 1762, 12 February 1763); the final one is in the da Costa collection.

The Zentralkartei der Autographen of the Staatsbibliothek in Dahlem has records of only five other Pallas letters in the forty-six libraries so far covered (one letter in the Bayerische Staatsbibliothek in Munich, the rest in the Germanisches Nationalmuseum in Nürnberg). Pallas letters are not included in the East German catalogue *Gelehrten- und Schriftstellernachlässe in den Bibliotheken der Deutsch–Demokratischen Republik.*

There must be da Costa letters in very many libraries and institutions, but an exhaustive search has not been attempted here. However, the following items have been noted:

a. *British Museum* (*Natural History*), *London.* Twelve da Costa letters (? 1774 and 1776–78) are in a bound volume of letters to Richard Pulteney entitled 'R. Pulteney Letters from Bryer, da Costa, et al. 1776–1800'. There are no da Costa letters in the Joseph Banks collection, but a letter from Thomas Pennant to Banks refers to da Costa's frauds (Dawson, 1958 : 662).

b. *Linnean Society, London.* The Linnaean correspondence includes two letters from da Costa to Linnaeus and two of the latter's replies. There is also a letter from Peder Ascanius to Linnaeus referring briefly to da Costa's earlier term in prison. All these were reproduced by Smith (1821 : 482, 488–492 and comment on da Costa, p. 495). There is also a letter from da Costa to John Ellis (1755, Ellis Correspondence, calendared by Savage, 1948) and in the Pulteney Correspondence is one from Humphrey to da Costa concerning the purchase of shells (31 January 1782).

c. *Wellcome Institute for the History of Medicine, London.* Three letters (1748–62) addressed to Antoine Réamur, Isaac Romilly and A. P. Schrader.

d. *Fitzwilliam Museum, Cambridge.* In the Perceval Collection (L90, 91 and 93) is a letter from da Costa to William Hunter, a copy of the latter's reply, and one from da Costa to Dru Drury.

e. *Bodleian Library, Oxford.* Reference to da Costa's possession of Edward Lhwyd's papers is in a letter from John Fothergill to William Huddesford, Ashmole MSS. 1822, ff. 225–6.

f. *Royal Society, London.* There are fourteen letters or documents by da Costa, none relevant here.

g. *Haverford College, Pennsylvania.* There is an oblique reference to da Costa in a letter from John Fothergill to John Morgan in the Charles Roberts Autograph Collection (this and the preceding Bodleian letter are reproduced, with footnotes, by Corner & Booth, 1971 : 250–1 and 294–6).

h. *Mocatta Library, University College, London.* There is no original da Costa material, but amongst the Lucien Wolf papers are transcripts of wills and family records, of which four files under the headings B 20 Cos and B 20 Men deal with the da Costas and Mendes da Costas (including da Costa's will and that of his father). 01/387/7050

i. *National Library, Edinburgh.* A letter from Peter Collinson to da Costa (No. 583, f. 695).

j. *Derbyshire County Library, Derby.* About sixty papers, including a number of letters, many of which refer to Derbyshire minerals; about half the notes are written in Latin or French and very few are signed (Parcel 9X).

Another useful source has been the Public Records Office in London. For the dates of da Costa's second sojourn in prison a record appears in volume 4 (p. 203) of the Commitment Books of the King's Bench Prison, together with a note of the indictment and a margin entry recording his discharge. His name does not appear, however, in a book of admissions and discharges (King's Bench and Fleet Prisons, Miscellanea, 1696–1862, PRO. PRIS. 7, 1776–1862, 79 bundles). For some reason his case was not recorded in the Great Doggett of the King's Bench Crown Rolls (PRO. IND. 6660–1), nor in the Controlment Roll of that Court, nor in the King's Bench Indictments (PRO. K.B. 10. 36 for Michaelmas Term, 1768). The Judgement Rolls (Plea side) of the King's Bench for 1768 (PRO. IND. 6229–30) were also searched without success.

For details of da Costa's downfall there is a record in Lyons (1944), but the best source is the Minute Book (vol. 5, 1763–68) of the Council of the Royal Society, which gives a blow-by-blow account of the discovery of his frauds and the actions taken against him. Towards the end of the affair, however, the Council's attention was increasingly diverted to the arrangements for observations of the transit of Venus by Captain Cook and others. One almost senses the relief with which the Council turned from the last report on the da Costa affair (his imprisonment) to a cheerful letter from Cook in Madeira blithely announcing his use of Society funds to purchase wine for himself and Mr Green the astronomer.

For convenience when citing these sources, the following abbreviations have been used in the text:

Add. MS.	Additional Manuscripts, British Library
Banks Corr.	Correspondence of Sir Joseph Banks (copies) in the British Museum (Natural History); these letters are calendared by Dawson (1958)
DC. Corr.	Da Costa's correspondence bound in 11 volumes, Manuscript Department, British Library, Add. MSS. 28534-44; a number of these letters were published by John Nichols (*Lit. Anec.* and *Ill. Lit. Hist.*, see below)
DC. Gen.	Da Costa's genealogy, written by himself, in Add. MS. 29867; published by Nichols (1812a)
DC. Lib.	Catalogue of da Costa's library, written by himself (final date, June 1782), Add. MS. 9389

Drury Corr.	Letter-book of Dru Drury, British Museum (Natural History); 30 letters quoted by Cockerell (1922), indexed by Sherborn (1937)
Drury AB.	Dru Drury's account book for the *Illustrations of natural history*, British Museum (Natural History)
Ill. Lit. Hist.	*Illustrations of literary history* – see Nichols (1817–31)
Linn Corr.	Linnaean correspondence. Linnean Society; letters of Ascanius to Linnaeus, da Costa to Linnaeus and replies – quoted by Smith (1821); also, Rev. J. Goodenough to J. E. Smith mentioning da Costa – quoted by Smith (1832 : 267)
Linn. Arch.	Linnean Society archives, containing records of members; also rule books and other papers of the Society for Promoting Natural History
Lit. Anec.	*Literary anecdotes* – see Nichols (1812–16)
Moc. Lib.	Lucien Wolf papers in Mocatta Library, University College, London; wills of da Costa and his father
Pult. Corr.	Da Costa letters in Pulteney correspondence, British Museum (Natural History)
Perc. Corr.	Da Costa letters in Perceval Collection, Fitzwilliam Museum, Cambridge
PRO. PRIS. 4	King's Bench Prison Commitment Books, volume 4 for 1767–72, Public Records Office, London
Well. Inst.	Da Costa letters in Wellcome Institute, London.

George Humphrey

Of the two possible authors of the *Conchology*, George Humphrey was certainly the less qualified to write it, at least at that time, since he was essentially a London dealer and collector of natural history specimens and other 'curiosities', only later becoming a compiler of sale catalogues and eventually an amateur conchologist. Humphrey has never found a biographer although he well deserves one, having been at the centre of natural history transactions throughout the exciting period when Captain Cook's ships were bringing back rarities from the Pacific (see, for example, Whitehead, 1969). A summary of his career will be given elsewhere (Whitehead & Kaeppler, in prep.).

Humphrey's sole scientific publication was a short note on the gizzard of *Bulla lignaria* = *Scaphander lignaria* Linnaeus (Humphrey, 1794). Although he dealt in all manner of curiosities, shells seem to have held a special attraction for him, at least in the latter part of his career. A letter written by Humphrey to J. T. Swainson in 1815 (quoted by Jackson, 1937) is full of criticism of da Costa and gives a list of errors in the *Conchology*. It was this that convinced Jackson of Humphrey's authorship (although the reverse could be better argued). Towards the end of his life Humphrey met John Edward Gray (1800–79), later Keeper of Zoology at the British Museum. 'I recollect him well', wrote Gray, 'and was strongly impressed with his knowledge not only of species of shells, but also of the affinities which the groups bore to each other. Though comparatively an uneducated person, he was far in advance of the state of natural history of his time' (Gray, 1858). When the *Conchology* was being produced, however, Humphrey was most likely a beginner, with a good collector's knowledge but no more. He certainly sought da Costa's opinion in one instance when he was puzzled by a specimen in the British Museum.

> Enclosed is a drawing of a small unperforated Ear which they have at the Museum – They class it as such, perhaps you may think it a snail. If it is an ear please return it [symbol for *per*] Bearer.
>
> (Humphrey to da Costa, 6 March 1771, DC.Corr.)

Humphrey's first recorded address was 48 Long Acre, London, from at least 1769 and during the period that he wrote to da Costa, as well as 30 St Martin's Lane from at least 1770 (DC. Corr.) In May 1778 he opened his *Museum Humfredianum* at the second address, but he seems to have kept the Long Acre residence since he wrote from that address again (at least in 1782) some years after the museum was sold in 1779. Thereafter, he dealt in curiosities and he catalogued many sales of mainly natural history specimens (Fothergill sale, 1782; Calonne sale, 1797; and many minor sales). In about 1786 he moved to 4 Leicester Street, off Leicester Square. His final sale, marking his retirement, took place in 1823 (all shells).

It has been suggested by Jackson (1937) that the abrupt cessation of the *Conchology* (in the middle of the text for plate 5) stemmed from a quarrel between Humphrey and da Costa. This may be so, and certainly the letters break off after April 1771, but their tone is always amicable. In view of da Costa's authorship of the work and Humphrey's later claims to it, however, one cannot help wondering if Humphrey even at this early date was not trying to reap more credit for the work than da Costa cared to grant. Thus, da Costa's references to this 'Anonymous Conchology' may have been more pointed than modest.

E. M. da Costa

Emanuel Mendes da Costa (1717–91) came from a family of Sephardic Jews that had emigrated to England from France (his father's side) and from Portugal (his mother's side) in the seventeenth century. Like many such families, the genealogy of the da Costas and Mendes lines is complicated by marriage between cousins or with uncles, but fortunately the family relationships were carefully detailed by da Costa himself in a manuscript (Add. MS. 29867) which many years later was published by John Nichols in the *Gentleman's magazine* (Nichols, 1812a : 21–22).

Da Costa's paternal grandfather, Moses *alias* Philip Mendes da Costa, came to England from Rouen in Normandy in about 1692. His son Abraham *alias* John (also born in Rouen, 1683) came to England when he was 13 and in 1702 he married his first cousin Esther *alias* Johanna of Budge Row, London, daughter of Alvaro da Costa (who had come to London in about 1660 and whose sister had married da Costa's grandfather). This appears to have been the more successful side of the family, for Alvaro's son Moses *alias* Anthony rose to a high position in the Bank of England; he married his first cousin Catherine Mendes, who was born at Somerset House and was named after her godmother, Catherine of Braganza, wife of Charles II. Joseph Salvador, who later stood bond for da Costa, may have been the same that married Leonor, daughter of Emanuel's first cousin on his mother's side, Isaac 2nd Baron of Auverne le Gras; da Costa's aunt (on his father's side) also married a Salvador. The da Costa family, or at least the Alvaro branch, was of sufficient standing for a grant of arms to be made on 20 February 1723; in a punning reference to their name, the shield is blazoned with six ribs (Rubens, 1949 : 90, pl. 9, fig. 34 – da Costa's book-plate, of which examples are in Add. MSS. 9389 and 29867).

Emanuel da Costa was the eighth of Abraham and Esther's ten children (DC. Gen.). His father claimed to have given him a good education (Moc. Lib.) and according to Goodwin (1887) he was destined for 'a lower branch of the legal profession' and for period at least served in the office of a notary. I cannot find any other reference to him before 1740 when Nichols (*Lit. Anec.* **3** : 757) recorded that da Costa, then 23, was a member of the Aurelian Society which met at the Swan (afterwards King's Arms) in Cornhill. In 1746 da Costa was elected an Extra Regular Member of the Spalding Society and in their lists is cited as a 'merchant' (history and list of members, *Lit. Anec.* **6** : 81). By now he seems to have made his mark in quite high circles, for in November the following year he was elected Fellow of the Royal Society, being recommended as 'a Gentleman well skilled in Philosophical Learning and Natural Knowledge, particularly in what relates to the Mineral and Fossil parts of the Creation'. His sponsors were the Duke of Montagu, Martin Folkes (President of the Royal Society), Henry Baker, Peter Collinson and several others.

In 1752 da Costa was also elected Fellow of the Society of Antiquaries; he is said to have been something of an authority on old silver and jewellery (Lyons, 1944 : 169). He later presented the Society with a sepulchral tablet of micaceous stone which was inscribed with the words 'Manilius / Hilarius vixit / Annos L'. In a footnote, Way (1847 : 10) commented dryly, 'The authenticity of this inscription may appear questionable'.

Da Costa was more than just a 'clubable' man and good talker. In 1752 he drew up an invitation to subscribers for his first book, the *Natural history of fossils*, to be issued in two volumes at a guinea each (Maty, 1752 : 236–238; also, *Lit. Anec.* **2** : 292), although the book was not finally published until five years later (da Costa, 1757). However, even before seeing it, and on the basis merely of a letter from da Costa, Linnaeus in his generous way was full of enthusiasm. He saw to it that da Costa's letter (of 5 April 1757) was read to a full meeting of the Royal Academy of

Sciences in Uppsala and he reported how da Costa's 'unparalleled knowledge and rare learning have excited so much esteem and respect in all those who were present' (English from Latin, 9 November 1757, Linn. Corr.; quoted in Smith, 1821 : 488). In a subsequent letter, Linnaeus claimed that in his preparation of the tenth edition of the *Systema naturae* he could not dispense with da Costa's work 'as I intend to quote it with due commendation, throughout the fossil kingdom' (Smith, 1821 : 489). Elated, da Costa basked in this praise and hinted that election to the Royal Academy of Sciences would be gratifying; however, even a second and more pointed hint the following year had no success (10 February 1758 and 5 October 1759, Smith, 1821 : 489, 492). John Edward Smith commented on da Costa's subsequent antipathy to Linnaeus 'which the writer of this has often heard him express' (Smith, 1821 : 495) and it may have been partly for this reason that da Costa later castigated Linnaean terminology so strongly, insisting that he had to 'explode the Linnaean obscenity in his characters of the Bivalves; not only for their licentiousness, but also that they are in no ways the parts expressed'. He went on (with perhaps just a hint of a Pope couplet in mind)

> Ribaldry at times has been passed for wit;
> but Linnaeus alone passes it for terms of science.
> (*Elements of conchology* : iv)

By 1763, at the age of 46, da Costa was already a well-known and much respected member of the antiquarian and scientific worlds. In addition to his book on fossils, he also published eight short papers in the *Philosophical Transactions* of the Royal Society and he was in correspondence with many of the prominent literary and scientific figures of his day. For example, as early as 1747, Sir Hans Sloane (1660–1753) wrote to da Costa promising 'to entertain you without interruption with the sight of anything in the power of your humble servant . . .' (*Ill. Lit. Hist.* **4** : 84). In the same year Martin Folkes (1690–1754), later President also of the Society of Antiquaries, urged da Costa to join him at the Duke of Richmond's seat in order to help embellish a 'wild receptacle and grotto' with fossils (*Ill. Lit. Hist.* **4** : 635–6). Another close acquaintance was the antiquarian William Stukeley (1687–1765), whose command of Hebrew da Costa had once criticized; Stukeley was obviously much impressed with da Costa's learning (*Ill. Lit. Hist.* **4** : 505, 566). Andrew Ducarel, the antiquary, after visiting Paris in 1752, wrote to da Costa saying that he had been to see the great Buffon 'at whose house your name was mentioned, and some other handsome things said . . .' (*Ill. Lit. Hist.* **4** : 608). In fact, a review of the names in the volumes of the da Costa correspondence shows the extent to which he was integrated into the intellectual circles of his time.

By all accounts, da Costa was a devout Jew, receiving some good-natured teasing on one occasion when Folkes suggested that the lobsters of Chichester might prove 'a temptation, by which a weaker man might be seduced' during a visit to the Duke of Richmond (*Ill. Lit. Hist.* **4** : 635). Thomas Birch (1705–66) felt that 'your religious profession might possibly be a prejudice to you with some persons; but ought not, I think, to discourage you from offering yourself as Candidate [for Clerk]' (*Ill. Lit. Hist.* **4** : 540). The Jews Naturalization Act had been passed, but rapidly repealed (due to ecclesiastical and commercial opposition) in 1753, but there was probably little discrimination in the scientific community. Da Costa was able to assure Birch that he found 'no Objection on Account of Religion' (Add. MS. 4303, f. 182). The general tone of the letters written in this period suggests that da Costa was genuinely popular among both scientists and antiquarians and that he was considered to be something of an authority on a wide range of subjects, from Hebrew inscriptions and Jewish uniforms, to volcanoes, rocks and fossils.

Da Costa married in 1750, within the Portuguese Jewish community, his wife being Leah the third daughter of Samuel de Prado (on 14 Nisan 5510, being 20 April 1750 – Barnett, 1949 : 91). They had no children and Leah died in 1763 (DC. Gen., date not given). In the same year he also lost his father, on 11 February in his own records (DC. Gen.), but 11 January in the transcript of his father's will (Moc. Lib.). The latter date is more likely since he wrote to Thomas Birch on 20 January and spoke of 'My Greif on this Occasion . . .' (Add. MS. 4303, f. 184). He married again, about three years later, his second wife being Elizabeth Skillman (possibly Stillman) and they had one daughter (Goodwin, 1887); his wife was a Gentile, but da Costa is said to have kept the faith (*Encyclopedia Judaica* **5** : 986).

There seems to have been only one small peccadillo, small enough at the time but in retrospect all too clear a pointer of what was to come. On the surface, or at least in the eyes of most of da Costa's scientific and antiquarian friends, his career held fair promise. At another level, however, there were undertones, not yet of dishonesty, but of a recklessness over money that could – and indeed would – lead to it. In a letter to Linnaeus of 7 April 1755, Peder Ascanius (1723–1803) said that da Costa had been sent to prison for debt. Da Costa, he wrote, 'certainly possesses an excellent collection of minerals; or rather, I should say, he did possess it; for he is at present in prison for debt. But his collection is in the hands of a friend, who allows him partial use of it' (Linn. Corr.; quoted in Smith, 1821 : 482). Peter Collinson (1694–1768) once exclaimed 'Thou art the archest wag alive', referring to the way that da Costa had relieved an old don of fossils and a *hortus siccus* (Fox, 1919 : 212), but it would seem that da Costa's passion for specimens and books was already outrunning his resources.

The real indictment of the da Costa of this period is found in his father's will, a rambling document in which the old man complains bitterly of the 'shocking misfortunes' he has had to bear in his business life 'and not one son to give a helping hand for to retrieve, but, on the contrary, they have all set their hands who should destroy most and also their credit, which I had taken so much care to settle and advise them to take care to keep' (Moc. Lib.). Emanuel and David 'have done very bad' and he wishes they had followed his advice and found wives with fortunes, for it shocks him to think of bringing so many beggars into the world in his family; 'you were all young and healthy and no father mother nor sister to maintain but your own sweet selves and that you would not do'. The will is undated, but the first part appears to have been written before 1752 when his brother Jacob died and then completed shortly afterwards, by which time his son David is cut off with almost nothing (and only 5 shillings if he proves in any way troublesome). If this dating is correct, then da Costa's imprisonment in 1754 must have marked the end of his father's financial help.

Nevertheless, da Costa's personal troubles were either ignored or little known to his scientific friends, for in 1763 the high regard in which he was held culminated in his election to the responsible post of Clerk to the Royal Society. Among those who supported his application was Stukeley, who wrote to a friend 'I know he has many friends. All my corner of the room unanimous: Sir William Browne, Collinson, Parsons, Baker, Clark, Van Rixtel &c. &c'. (*Ill. Lit. Hist.* **4** : 566). Thomas Birch appears to have backed him (presumed from Add. MS. 4303) and there must have been many others. Rarely can the members of a society have so misjudged their man.

On 3 April 1763 da Costa was duly elected Clerk of the Royal Society, as well as its Librarian, Keeper of the Repository and Housekeeper. He and his family were provided with rooms at the Society's premises at Crane Court, off Fleet Street, and he received £50 a year for his duties. The salary was not high, although Dr Johnson once pronounced £50 to be 'undoubtedly more than the necessities of life require', but there was no rent to pay and he also received some small sums for book-keeping and cataloguing. In addition – and ironic in the light of subsequent events – da Costa was encouraged to solicit members' dues by a grant of a shilling in the pound for all he collected. As a precaution, he was required 'to give a Security of One thousand pounds for the performance of the Duty assigned to him'. The Minute Book of the Council, from which this account is taken, shows that in June that year Joseph Salvador (his cousin *fide* letter to Salvador, 20 January 1786, DC. Corr.) and Samuel Felton, both Fellows of the Society, signed his bond, little realizing that even before the bond was delivered, da Costa had already misappropriated the first of what would eventually be more than a hundred members' subscriptions. In 1763 he pocketed a dozen subscriptions; in the next two years he annually helped himself at twice that rate; in 1767 nearly forty subscriptions failed wholly or partly to reach John West, the Treasurer. *Hilarius vixit* no doubt, but it could hardly last. The wonder is that he was not found out sooner.

In a letter to Joseph Priestley of 14 June 1766, congratulating him warmly on election to the Society, da Costa outlined the two methods by which dues could be paid (*Ill. Lit. Hist.* **4** : 541–2). The first was by a five guinea admission fee and the signing of a bond for annual payments of £2.12.0; the second was by a single payment of 25 guineas. 'The latter way is the most eligible, and more agreeable to the Society', wrote da Costa, and the unsuspecting Priestley duly obliged.

According to Drury (28 February 1768, Drury Corr.), it was John Hope, Professor of Botany at Edinburgh, who first asked why his name did not appear in the list of perpetual members. Hope then asked someone to investigate this for him, and he too found that his name was given as an annual and not a perpetual member. Questions began to be asked and an enquiry was instigated. Da Costa must surely have been aware of this, but he seems to have been unprepared when, on Thursday, 3 June 1767, the axe fell. That morning the Council met, called in their Clerk, and demanded an explanation for omissions in the books amounting to no less than five hundred pounds. The unfortunate da Costa, 'after several excuses and prevarications', which were of little avail, was finally forced to admit his guilt. He was then suspended from his duties and told to hand over his keys of the Libraries, Repositories and Closets to William Kirkby, the Society's solicitor. Kirkby was then instructed to contact da Costa's two bondsmen, Felton and Salvador. The latter wrote back in evident astonishment and mortification, but he assured the Society that he was ready to honour his covenant; Felton, with perhaps slight reluctance, agreed to do likewise. They then instructed their own solicitor, a Mr Le Breton, to have a Judgement entered against da Costa and 'Execution issued against his effects'. As yet, they had no inkling of the true extent of da Costa's frauds and were clearly determined to rescue their bonds at da Costa's expense.

Meanwhile, however, the Council had probed further back into the accounts and had discovered additional omissions which totalled the equally enormous sum of £472.10.0. On 14 December da Costa was brought once again before the Council and he now admitted what he had previously denied, that Sir John Naesmith's was also one of the subscriptions that he had appropriated. He also gave a brief list of his possessions (specimens – including, one supposes, the Brazilian emeralds that Pallas so coveted – books, papers, etc.), being those on the Society's premises. In return the Council handed him an account of their claims against him, which now reached a grand total of £1090.19.0. Da Costa clearly saw the hopelessness of his position. He came before the Council the next day, queried two small items in the list, but pleaded guilty to the rest and said that he could not recall any further omissions. Two more were promptly cited and he meekly agreed them.

By now the debt had exceeded the bond and the Council, fearing that worse might come, demanded an account of his resources. Da Costa spoke of his personal possessions, now in the process of being seized and sold by his bondsmen, and of a very small annuity, a life policy and a copyhold in his wife's name, 'but no cash or any other effect'. His bonds were then taken from the Iron Chest and handed to Kirkby.

Thoroughly alarmed, but determined to fathom the depths of these frauds, the Council heard Kirkby report on 17 December that he had examined the official Checque Book and had discovered another £266.10.0 not accounted for. Kirkby then showed the Council a bill of sale, dated from the previous Sunday, for some four hundred books from da Costa's own library sold to Dr John Letch, F.R.S. (and another whose subscription da Costa had appropriated). Letch was called for and told firmly that the Society had no powers to deliver the books. The Council then formally dismissed da Costa from his various posts and that afternoon the affair was made generally known to the Society's members. Pennant was outraged and wrote to Joseph Banks that 'I expect daily to see our Society in the Bankrupt's list, since the trick my worthy friend da Costa has served us' (25 December 1767, Banks Corr.).

To what extent da Costa was able to call on his relatives and friends is not recorded, but it must have been a bleak Christmas. The family moved out of Crane Court on Christmas Eve and their possessions were taken across to Samuel Paterson the auctioneer at Essex House in Essex Street off the Strand. As da Costa complained to William Hunter, he was later denied the chance to manage this sale (Perc. Corr., 10 January 1771), which implies that his books made much less than he had been offered by John Letch. Possibly it was during this period that he managed to settle other debts by selling books and manuscripts not impounded at Crane Court. His patient friend John Fothergill (1735–80), who had a reputation for helping lame ducks, said that he had purchased Edward Lhwyd's papers from da Costa, or 'at least I accepted them as payment for a large debt' (cited in Corner & Booth, 1971 : 294). Da Costa had bought these papers (about 500 letters in two large portfolios) in 1757 and had later lent them to William Huddesford for his work on Lhwyd and his *Lithophylacium*. Similarly, da Costa may have been able to sell off a few of his specimens, but from the evidence in his father's will he could expect nothing from his brothers and probably not even sympathy from his sister Sarah.

Bad as things already looked, the new year brought to light still more discrepancies in the books and on 3 January a further three hundred pounds was reported to the Council. Three weeks later, on 28 January 1768, a full account of da Costa's debt to the Royal Society was drawn up, comprising 122 entries and totalling £1492.14.2. Salvador and Felton, the latter now very reluctant, managed to delay proceedings into the next term of the High Court, but on 10 May the case was heard in the Court of the King's Bench and they were ordered to surrender their bond. Two days after this, da Costa's 'entire library of printed books and MSS. and collection of prints and drawings of Natural History' was sold at Paterson's auction rooms, a fact that significantly is the only biographical detail given by da Costa against his name in his genealogical table (DC. Gen.; also cited in Nichols, 1812a : 24). Da Costa's natural history collection had already been sold at Paterson's on 25 April. Da Costa possessed catalogues of both these sales, but tantalizingly, in his library catalogue, he did not record the amount raised (DC. Lib., f. 31r and v). Since his debts seem to have been largely incurred by reckless buying of books and specimens (nowhere is there a hint of high living, even in his father's disparaging will), these sales may have gone some way toward placating his bondsmen, for on 2 June Felton attended a Council meeting and after a little hesitation agreed that he and Salvador would pay costs as well as surrender their bond.

The accounts show that the Royal Society retrieved the thousand pounds from the bond, but the Society was still considerably embarrassed by the remaining debt, stated to be £416.10.3. Counsel's opinion was sought and it was decided to proceed against da Costa.

Some clue to da Costa's character emerges from letters that he wrote during this period to John Anderson (DC. Corr.). Answering da Costa's letter of 14 January (no copy kept), Anderson apologized for not replying sooner but he had heard that da Costa 'had gone privately to Portugal'. Incensed, da Costa wrote back (14 July 1768) that 'the malice of my Enemies' invented this lie, which 'was not the only infamous falsehood they engaged', but 'they were soon drove from these lies in that I have never strayed a single step from the Metropolis and have dwelt ever since within sight almost of Crane Court. I have always appeared publikly & have had the Honour to be conversant with numbers of F.R.S. eminent not only for their learning but for their humanity. A greater proof of which cannot be urged than that of giving Public Lectures or Courses on fossils which I began last month [June] and have several F.R.S. my subscribers among which Drs Hunter and Fothergill cannot be unknown to you . . .' The bravado is incredible, for by now da Costa had been dismissed from his job, evicted from his home, expelled from the Society of Antiquaries for 'infamous conduct' (24 May), and had had his possessions sold by auction, while among the eminent names that accused him from the pages of his falsified accounts were none other than those of William Hunter and John Fothergill.

Anderson wrote back to express relief that the reports were so ill-founded, but the days of da Costa's defiant posturing before Crane Court were numbered. On 7 November 1768, by a Writ of Special Capias, he was detained by the Sheriff and two days later he was committed to the King's Bench Prison at St George's Fields (PRO. PRIS. 4, **4** : 203). The journey across Blackfriars Bridge did not end his career as a naturalist, but it rang down the curtain on all those advantages to be reaped from having friends in high places. Like Johann Reinhold Forster (1727–98) and Rudolph Erich Raspe (1737–94), his two equally unfortunate and subsequently disgraced contemporaries,* da Costa was to find what a thankless task was science without the blessing of the Establishment.

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* Although da Costa, Forster and Raspe, so similar in their breadth of learning and temperaments, certainly knew each other, their association has never been fully explored. Da Costa translated into English Forster's *Specimen historiae naturalis volgensis* of 1767, while Forster examined da Costa's collections and commented on them in his lectures at Warrington Academy in 1767–8 (Hoare, 1976 : 44, 55). Raspe stayed with the Forsters in the summer of 1776 and helped with the German translation of George Forster's *Voyage* (Hoare, 1976 : 165). Seen in this light, the question of the authorship of the anonymous *Travels of Baron Munchhausen* (1785), which Carswell (1950) attributes to Raspe, could well be re-examined. Perhaps all three 'tactless philosphers' helped to pen this piece of mischief on some long summer evenings at 16 Percy Street back in '76.

King's Bench Prison

There were, however, some compensations. The King's Bench Prison, at St George's Fields on the junction of Blackman Street and Newington Causeway, had at that time a reputation for its lax rules. Writing of a slightly earlier period, Macky (1722) had noted that 'its rules are more extensive than those of the Fleet' and by a 'Habeas Corpus you may remove yourself from one prison to the other . . .', a practice apparently adopted by some inmates merely to provide a welcome change of scene. Some impression of da Costa's circumstances in the prison, as well as his still unrepentant attitude, can be seen in the draft of his letter to Stanesby Alchorne (1727–1800), Assay-master at the Mint and an amateur botanist, dated 'King's Bench Prison 21 February 1769' (his deletions are placed in parentheses).

> Tho in a prison placed by (the Royal) a Society founded for promoting Nat. Knowledge at (the very time I was given a second course of . . . Natural History of fossils in order to destroy . . . a kingdom of Nature not yet rightly explored) a *see infra I have been so fortunate to meet a family in the same unhappy situation of Prisoners who not only delight in Nat. Hist. but also in Music & painting & they having a fine large commodious & extreme pleasant room commanding an extensive (& beautiful) prospect they have granted me leave to study (to) read my Lectures in it. & Dr MacKenzie & other Gent^{n} to the number of 20 generously having subscribed I am now actually reading a Course wch meets with such approbation that a new sett of Subscribers is forming for a subsequent one.

Then follows a request to borrow for a fortnight the *Synopsis methodica stirpium Britannicarum* of John Ray in order to help Dr Colin MacKenzie to identify his large collection of marine plants. The letter continues,

> I have only to add that if you have at any time a spare hour and will pleasure me with a visit I shall be extremely glad to see you & enquire for me at the Gunroom in the State house.

At the bottom of the letter is the final form in which da Costa, with a bland disregard for the reasons behind his imprisonment, complains of the Royal Society's action.

> * beginning of 2^{d} paragraph supra
> Tho placed in a prison by a Society founded for Promoting Natural Knowledge at a time when I was promoting Natural Knowledge in a course of Lectures on fossils I have been &c.
> (draft to S. Alchorne,
> 21 February 1769, DC. Corr.)

A number of other friends seem to have remained loyal to da Costa during his time in prison. One of these was Ingham Forster (1725–82), brother of the natural history dealer Jacob Forster (1739–1806) who had married George Humphrey's sister Elizabeth (see notes and family tree in Whitehead, 1973). Ingham Forster, who was a dealer in Clement's Lane, Lombard Street, appears to have corresponded frequently with da Costa and was designated 'My dear friend' in one of the latter's brief biographical sketches (Nichols, 1812b : 515). Da Costa seems to have helped Forster with his catalogues, for three weeks after his arrival in the King's Bench Prison, Forster wrote saying 'you will likewise receive three volumes of your catalogue interleaved' (28 November 1768, DC. Corr.). Forster continued,

> I wish you Health to prosecute your Studies, & Spirits to support you against the malicious designs of your Enemies: – Be assured you'll ever find me
> Your friend and obed^{t} Serv^{t}
> I shall call & see you the first opportunity

Two months later, da Costa told him that 'I have now finished the Catalogue of the large Collection of Marbles' (11 January 1769, DC. Corr.). Their relationship seems to have been a particularly warm one. In the summer of that year Forster wrote 'I will see you soon (please God) for I long to have a few minutes conversation' and in the autumn 'I am sorry it has not been in my power to pay my duty to your Fossilian Majesty this long time' (5 July 1769 and 2 October

1769, DC. Corr.). Although seven years younger than da Costa (who was now 52), Forster would often adopt a flippant, almost patronizing tone in his letters. Referring to work that da Costa was doing for him, Forster wrote 'You have been a very good Boy indeed! – Let us go on Briskly while the days are long and the Weather fine' and 'As I have given you a large number of Holidays, I hope *like a good Boy* you will apply closely to Business' (5 August 1771 and 24 January 1772, DC. Corr.). That this was perhaps not resented is suggested by Forster's use, after an initial period of signing himself 'I F', of the nickname 'Ferrum' (from 5 October 1772).

However depressing the King's Bench Prison may have been, da Costa's time there seems to have been extremely well spent; he certainly kept himself interested and in touch with outside events and he both ameliorated his living conditions and helped to meet his debt. One of the means that he adopted was the giving of courses of lectures, the second of which, scheduled for some time after July 1769, was thought to be too expensive by Forster. Da Costa was urged 'to endeavour to make the Expense of attending as reasonable as you can . . . the Proposal of 2 Guineas or 2/6 [symbol for *per*] Lecture I totally disapprove'; Forster recommended only 30 shillings the course or 1/6 per lecture (Forster to da Costa, 30 May 1769, DC. Corr.). The first set of lectures (on fossils) had apparently taken place in February and one supposes that da Costa continued to use the 'large commodious & extreme pleasant room' of his cultivated prison neighbours. The lectures seem to have been a success and a third series was planned the following year. Thus, George Humphrey, on behalf of Captain Thomas Cornwall, asked if da Costa could spare one of his syllabuses and on what terms, since Cornwall could not attend the course (24 January 1770, DC. Corr.). Humphrey wrote again the following month reminding da Costa that Cornwall would like a printed version of the lectures (February 1770, DC. Corr.) and da Costa duly dispatched a syllabus *via* Dr MackKenzie, who immediately paid the required 3 guineas for it (da Costa to Thomas Cornwall, 4 April 1770, DC. Corr.). In 1771 da Costa gave yet another series of lectures on fossils beginning in April, which was to be followed by a series on shells (da Costa to John Fothergill, 4 April 1771, DC. Corr.).

If da Costa managed twenty subscribers to each of his courses of lectures, then even at the reduced rate recommended by Ingham Forster he would have reaped over a hundred pounds, not counting the profits made on the sale of printed versions of the lectures. Another source of income was catalogues (such as that of marbles for Ingham Forster – see above) and also translations and revisions. Thus, he revised and prepared for press the English version of the *Essay towards a system of mineralogy* by Cronstedt (1770 – translated by Gustav Engestrom, with a Preface and notes by da Costa), for which he received 8 guineas and a promise that his name would appear on the title page (Agreement dated 3 April 1769, DC. Corr.). His footnotes in this work are marked 'D.C.' and it is interesting to note that in some copies of the second English edition (published 1788), the printer, presumably on da Costa's insistence, pasted in a small label drawing attention to this fact since da Costa's Preface was now omitted. According to his library catalogue, da Costa's own copy had 'Mr Brunnich's and my MSS. additions & notes' but it was 'Stole from me by Mr Debraw' (DC. Lib., f. 11v).

Of translation work in this period, the only recorded project (but there may well have been others) was for Drury's *Illustrations of natural history*, for which da Costa did the parallel French text for the first two volumes. A note in Drury's letter-book (Drury Corr., p. 150) lists payments made in 1768–69, but a more complete record appears in Drury's account book, showing that da Costa received three payments in 1768 (£4.14.6), two in 1769 (£4.4.0), and one in 1770 (£10.14.6), all for volume 1 of the work, and a part payment in September 1771 (£5.5.0) for volume 2; Drury also paid him a shilling for translating a letter (Drury AB.). Da Costa's knowledge of French may have stemmed from his childhood, since both his father and grandfather had come from Rouen (DC. Gen.). His letters to Antoine Réamur are fluent (DC. Corr.) and in a letter to Isaac Romilly he jokes of professing 'some Antigallican Principles' but implies that he is perfectly capable of conducting the business in French if he wishes (25 June 1748 and 22 December 1755, Well. Inst., No. 56485). Da Costa's French was in no way stylish and it was perhaps for this reason that the publisher Elmsley 'found great fault' with it (Humphrey to da Costa, 12 April 1771, DC. Corr.). He may at this time have been responsible for a translation from Latin of 'Principles of Testaceology', a paper delivered at Uppsala by Adolphus Murray on 29 June 1771, of which the translation exists as a 23 + 3 page manuscript (Linn. Arch.). Although in another hand, da Costa's authorship is implied by the second part, the 'Author's Apology', which takes da Costa's familiar anti-Linnaean stance against certain offensive terms borrowed from misplaced analogies with human anatomy.

The length of da Costa's stay in prison has never been stated accurately in the literature. The Writ of Execution (Capias ad Satisfaciendum), which had commanded the Sheriff to deliver da Costa to the prison, ordered that he should remain there 'till he made satisfaction'. With his library and collection sold to pay off his bondsmen and no other resources to fall back on, da Costa's friends evidently did not expect to see him free for some years at least. Drury even wrote to Pallas that da Costa was 'confined in ye King's Bench Prison at ye instance of Royal Society and has been there near a year, from whence, I imagine, he will never return' (14 January 1770, Drury Corr.). In April 1772, however, da Costa's friend Thomas Hughes of Gossamer End near Berkhamsted wrote a delighted letter rejoicing at his 'soon expected enlargement' and inviting him to spend a few days with him and his wife (16 April 1772, DC. Corr.). The lectures, sale catalogues, translations, profits from the *Conchology* and fee for the Cronstedt book were surely not enough to cover the four hundred pounds owed to the Royal Society, so perhaps friends like Fothergill, Drury and others gave him some help. At any rate, by September da Costa was able to write to another of his loyal friends, Mitford Flower of Bedlington in Northumberland, to say 'I shall go from this place (where thou saw me) next month' (12 September 1772, DC. Corr.).

At last, on 8 October 1772 at the General Quarter Sessions at Kingston, da Costa was discharged under the Insolvent Act (PRO. PRIS.4, **4** : 203 – note in margin) and he set about making a new life. It was not to be easy, as he said to Thomas Hughes:

> Tybo presents her [deleted] his Duty She [deleted] He says he is now clear of the World & owes not a farthing to anyone but sighs and adds times are so hard he does not know how soon he may be in debt again.
>
> (27 November 1772, DC. Corr.)

Thereafter, for nearly twenty years until his death in 1791, da Costa struggled to make a living, as a dealer in shells and minerals, as a writer and as a lecturer. Apart from patronage, which da Costa had now largely forfeited, the eighteenth century offered to a man in his position little enough beyond what could be scraped from freelance work. He might, like J. R. Forster, have tried his luck abroad, but Forster had an energetic son to pave the way and was returning to a land and a language that he already knew. If da Costa's pre-prison letter to John Anderson is any clue, then da Costa was unrepentant and determined to brazen things out.

Later years

Some eighteen months after his release, da Costa asked the Oxford astronomer Thomas Hornsby (1733–1810) to help him institute a 2-guinea course of 27 lectures on fossils at the university (29 March 1774, DC. Corr.; also *Ill. Lit. Hist.* **4** : 516–9). Hornsby found that the Vice-Chancellor favoured the idea, but several people in the university advised him against it and he turned it down. 'I am very certain', wrote da Costa, 'my attempt has not succeeded by means of some unfriendly and sinister misrepresentations' and he swore that he would not try Oxford again 'at least until his Vice-Chancellorship expires' (*loc. cit.*). Without such official support, da Costa had to promote his lectures as best he could; he was certainly giving lectures in London in 1776 and 1777 (25 April 1776 and 4 September 1777, Pult. Corr.). A copy of the syllabus for his fossil lectures, dated 9 October 1778, is bound in with a copy of his *History of fossils* now in the Paleontology Library of the British Museum (Natural History). This syllabus (da Costa, 1778a) outlines an introductory and 27 main lectures and was probably the course offered to Oxford four years earlier and perhaps essentially that given in prison; a copy of the syllabus is recorded in da Costa's library catalogue (DC. Lib., f. 25v) and another copy, again bound in with the *History of Fossils*, is in the possession of Dr V. A. Eyles, who mentions it in commenting on da Costa's contribution to petrology (Eyles, 1969 : 176, 178).

As Dance (1966) has shown, this was a time of brisk dealings in shells (as well as other natural curiosities) and da Costa now decided to become a dealer. From prison he told Mitford Flower that 'One article of my livelihood hereafter will be to buy and sell all the curious productions of Nature to those who study Natural History and make Collections . . .' and he proposed acting as Flower's agent; if acceptable, Flower could send him curiosities 'directed for me at Mr Ingham Forster in Clement's Lane Lombard Street' (12 September 1772, DC. Corr.). Apparently 'Ferrum' was continuing to help him. Da Costa's twelve letters to the physician, botanist and shell collector Richard Pulteney (1730–1801) in the period 1775–85 are frequently concerned with offers of shells (Pult. Corr., DC. Corr.) and da Costa's other loyal friend John Fothergill was forever being importuned 'to spend on some fine new specimen' (Fox, 1919 : 212). In 1779 da Costa attended the sale of Humphrey's *Museum Humfredianum* in St Martin's Lane and 'by my principles & self bought near £150' (da Costa to Richard Waring, 6 July 1779, DC. Corr.); da Costa's annotated sale catalogue (Hope Department, Oxford) shows that he bought 79 lots for himself and 64 on behalf of Humphrey. Although his activities as a dealer never rivalled those of Humphrey, they must have gone some way toward providing a living. In addition, his knowledge of shells and fossils brought him work on the cataloguing of other people's sales and he catalogued the shells, corals, fossils and cabinets of his friend Ingham Forster (March and May–June 1783, *Lit. Anec.* **9** : 799).

In 1776 da Costa published his *Elements of conchology* and two years later came his *British conchology* (da Costa, 1776, 1778b). Both were well received and although he could no longer place F.R.S. or F.S.A. after his name, he still managed 'Member of the Imperial Caesarean Academy Naturae Curiosorum, by the name of Pliny IV* and of the Botanic Society of Florence'. He raised 111 subscribers for the second work, of which no less than 22 were Fellows of the Royal Society, and the list of names gives some measure of his rehabilitation. Joseph Salvador is among them, as well as Fothergill, Drury, Anderson and Pennant. The book was dedicated, in flowery terms, to Sir Ashton Lever, whose Holophusikon or Leverian Museum was then exhibiting in Leicester Square; Lever must surely have bought many specimens from da Costa and he may have helped him in other ways.

Da Costa wrote no more books, presumably finding his financial reward hardly justifying the labour. His feelings on this come out well in a letter to Richard Hill Waring (? 1720–94?), a friend and subscriber to the *British conchology*. Failing to receive either acknowledgement or payment from Waring, he wrote testily:

> Good God here is a strange Encouragement indeed to a poor devil of an author when subscribers spurn him if he desires a subscription aforehand & deprive him of his due monies by not receiving the book according to their honour when the work is finish'd . . . such doings and similar fantastics for I have the luck to deal with such unthinking people has sour'd my temper & depress'd my spirits so much that I am resolved to quit all Authorship & be no more the Scape Goat of our English Literature Encouragement or Generosity.
>
> (23 October 1779, DC. Corr.)

Many of the names of da Costa's subscribers to the *British conchology* appear some years later, together with a rather shaky signature by da Costa himself, in a manuscript rule book for the Society for Promoting Natural History (1783, Linn. Arch.; also printed rule books and much manuscript material). Founded in October 1782, this society was a forerunner of the Linnean Society, overlapping it for four years until it was wound up in May 1792. Da Costa never joined the Linnean Society, but this may well have been his own choice, membership implying tacit approval of Linnaean obscenity. However, it is clear that by perserverance and a stubborn refusal to acknowledge his crime, da Costa had gradually wriggled his way back into the community that had damned him in 1768. For example, the physician Thomas Percival (1740–1804) strongly recommended da Costa to Josiah Wedgewood, urging the latter to be 'very civil to him', since he was much esteemed. Unfortunately, things did not turn out so well, for Wedgewood took an instant dislike to da Costa, thinking him 'the most disagreeable Mortal who bore the name of a Philosopher, I had ever known' and he gained temporary relief 'by sending him two miles to see a Flintmill' (Wedgewood to Thomas Bentley, 6 and 16 August 1774, see Farrer, 1976 : 189–190; also Meteyard, 1866 : 478). Percival was aware that 'there was some mistake in his [da Costa's] acc^{ts}. with the R: Society, but he hoped it was rather negligence than design . . . [he] is very high in his encomiums of da C—— as a sensible Man, of the most extensive knowledge, & equally extensive correspondence with the Literati all over Europe, amongst whom the D^{r}. says he is very much esteemed' (*loc. cit.*).

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* Nicknames, a curious relict from the days when scientific societies had need of secrecy, persisted in the present case until 1870; Goethe was Arion IV, Linnaeus Dioscorides II and Prince Albert merited Fredericus secundus Hohenstaufensis (Sarton, 1931).

Four years in the King's Bench Prison must have left some bitterness in a man so uncontrite as da Costa. Accepted on his own terms, with sympathy for his misfortune and respect for his learning, he could perhaps be again the popular figure of his Royal Society days. A hint of condescension (by Wedgewood?) or the tardiness of a subscriber (Waring) could draw forth what Drury meant when he spoke of da Costa's 'Temper and Principle [which] was sufficient to overturn a Kingdom' (Drury to Pallas on the collapse of the first Aurelian Society, 28 February 1767, Drury Corr.). Da Costa was not the only one to be thrown into bankruptcy, but there were differences. Drury himself was to fall into debt (for ten times the amount owed by da Costa) in his business as a silversmith and goldsmith 'the effect of which was O! terrible to relate, I was obliged to be a bankrupt'; but since this misfortune 'did not arise from extravagance or dishonesty the world saw my distress and pitied me' (Drury to Robert Killingly, 21 December 1778, Drury Corr.). George Humphrey also had his financial troubles, the sale of his museum in 1779 only a year after its opening being more or less forced on him by his creditors (who had to settle for 12 shillings in the pound – da Costa to Richard Waring, 6 July 1779, DC. Corr.). Drury was merely gullible and Humphrey perhaps over-ambitious, but da Costa had shown less honourable traits of character and his misfortune must have long remained tainted with 'ignomy and disgrace' in the minds of all but loyal friends.

Very little can be gleaned of da Costa's final years. He had drawn up his will many years earlier, on 13 December 1773, and he left everything to his 'dear and beloved wife Elizabeth Mendes da Costa otherwise Elizabeth Skillman' (not witnessed but after his death attested by Elizabeth Grigg and Charles Westricher – Moc. Lib.). His letters break off in the volumes of correspondence in 1787 and possibly he sold them and some or all of his other books and manuscripts to Benjamin White at this time. The catalogue of his library (DC. Lib.) shows that in 1782 he had something over two hundred books, as well as pamphlets, sale catalogues and manuscripts, but there are frequent deletions, presumably as he parted with some treasure to pay a bill. Among his books was a copy of his *Natural history of fossils* with 'interleaved MSS additions', and two copies of the *British conchology* interleaved and annotated, one coloured and bound in two volumes, the other plain in one volume. These have not been traced, but Donald MacAlister (in Nance, 1935) recorded an interleaved copy of the first inscribed 'Remarks and alterations made by Mr da Costa and copied in the year 1781 by James Smirnove' (but did not say where it was located; it is, in fact, in the library of the Geological Society of London). It would be of great interest to locate other annotated books, as also such items as 'A folio Copy book of Accounts Current MSS', 'A folio Copy book of Litterary Expenses MSS' and 'Copy Old Catalogues of my Collection of Animals & Vegetables' (DC. Lib.).

Da Costa evidently kept up as best he could with the scientific and antiquarian communities, carefully pinning his letters on to the blue sheets of the letter-books, attending natural history sales, lecturing perhaps, and joining in the discussions once a month at 19 Warwick Street where the Society for Promoting Natural History met 'on the Monday before full moon at 6 in the evening' (rule book, Linn. Arch.). His few recorded addresses (Arundel Street, 3 Bedford Street) were around Fleet Street and the Strand, where rents were not too high; there were compensations, however, for the coffee-house life, booksellers and general bustle were attractive and even Dr Johnson in his later years resisted the temptation to migrate to a more fashionable part of town. Da Costa's final address was 463 Strand as recorded in the 1790 members list for the Society (Linn. Arch.).

In May 1791, nearing his seventy-fifth birthday, da Costa died at his lodgings in the Strand and on the 22nd he was buried at the Bethahaim Velho or Old Cemetery of the Spanish and Portuguese Congregation at 243 Mile End Road, London (Barnett, 1962; see also Lysons, 1795 : 478). Custom would have required Psalm 51, David's cry of repentance – a broken and contrite heart, O God, thou wilt not despise. Contrite or not, da Costa's name has outlived the opprobrium once attached to it and his books take a modest but not insignificant place amongst those of his less wayward contemporaries.

The *Conchology*

The *Conchology, or natural history of shells* is in no way a fundamental work, but it merits attention for its illustration of shells in particular collections, some of which are types. Its authorship has been disputed, not very thoroughly, and its parts have never been dated. The authorship and dating can now be cleared up, chiefly on the basis of the da Costa letters, and something can be said of the illustrations.

Authorship

The authorship of the *Conchology* cannot be deduced from the work itself. The title page offers no clue, the work being merely 'By a Collector'. The Preface, unsigned, refers to an 'Editor' and also to an 'Author' in terms that imply that these were not the same person ('the Editor begs leave to acquaint the curious . . .' while 'the Author thinks it is his duty to inform them . . .'). The only names given on the title page are those of the printer (T. Jones, in Fetter Lane) and of the three people from whom the work could be bought: Mr B. White, Bookseller in Fleet Street, Mr Elmsley, Bookseller in the Strand, and Mr Humphrey, Dealer in shells and other natural curiosities in St Martin's Lane near Charing Cross. The Preface also implies that neither Humphrey nor the two booksellers acted as Editor. Thus, shells for description are solicited from other collectors and 'if they will honour the Editor to send them either to the Booksellers Messrs. *White* and *Elmsley*, or to Mr Humphrey, to be conveyed to him [i.e. the Editor], he will return them safe, and gratefully acknowledge the favour . . .'.

It is clear that two people were involved in producing the *Conchology*, an author who was a collector, and an editor, the latter apparently not being Humphrey (who also by implication does not admit to being the author either). As shown already (see p. 1), some writers have favoured da Costa's authorship, while others have settled for George Humphrey.

Support for Humphrey's authorship stems in part from his claim in the *Museum Humfredianum* where the work is given as 'HUMPHREY'S Conchology' (Humphrey, 1779 : 36th day). This is repeated in the Portland Catalogue (Anon., 1786 : v), which includes in its list of references '*Humph. Conch.* – A Conchology or Natural History of Shells published by Mr. Humphrey, 17 ' (i.e. no date given). Although it was the Rev. John Lightfoot and not George Humphrey who compiled the Portland Catalogue (Dance, 1962), da Costa noted that the 'natural history [was] made by George Humphrey, and formed or corrected by the late Rev. Mr Lightfoot, her Grace's Chaplain' (Add. MS. 29867; Nichols, 1812 : 516). The reference in Humphrey's own sale catalogue obviously carries the most weight since there is no doubt that Humphrey himself penned it. In fact, Humphrey had seven copies of the *Conchology* and, ironically perhaps, da Costa purchased one of these for 18 shillings (Lot 82, thirty-sixth day – annotated catalogue in Hope Department, Oxford).

Another hint of Humphrey's authorship occurs in letters between himself and da Costa at the time that the *Conchology* was being written. Among the repositories where there were shells for inclusion in the work was the British Museum. Humphrey visited and found that it was necessary to make a proper application to the Trustees 'in order to see the Shells, and Books relative thereto' as well as for permission for an artist to make drawings. He then asked da Costa to draft out such an application for him (April 1770, DC. Corr.). A copy of da Costa's draft is on the reverse of Humphrey's letter and it ends with a promise that the applicant (i.e. Humphrey) will present 'a copy of his intended work on its publication'. This letter is followed by Humphrey's rewritten application, which says that he will acknowledge the courtesy 'by humbly presenting a Copy of my intended work on its publication' (27 April 1770, DC. Corr.).

A further implication that Humphrey was the author comes in letters between Humphrey and the conchologist and collector Henry Seymer (1745–1800). Humphrey apparently sent to Seymer some kind of advertisement for the *Conchology* and the latter acknowledged 'your Proposals, Feb. 1, 1769' and added a word of caution on the 'expense and time your 'History of Shells' will take up' (16 February 1769, DC. Corr.; also *Ill. Lit. Hist.* 4 : 772). It would be interesting to know whose name if any was on the Proposal since 'your' could be singular or plural.

Taken together, these hints would seem to add up to Humphrey's authorship, but the case for da Costa's authorship is even stronger. In the light of what follows, Humphrey's name must be seen merely as a device for concealing da Costa's involvement at a time when he could expect little sympathy from certain potential subscribers or from the British Museum, the Duchess of Portland or others who might supply shells for description. Prison lectures were one thing, but the handling or loan of often rare and expensive shells might not be entrusted to a young dealer if it were known of his association with a man of da Costa's reputation.

Nevertheless, da Costa announced his authorship to at least a few people since Drury told Pallas that da Costa 'is at present engaged in writing a history of shells which he hopes will make its appearance this summer' (14 January 1770, Drury Corr.; quoted by Cockerell, 1922 and also by Iredale, 1922 : 86, who took this as evidence of da Costa's authorship). To Fothergill, da Costa at first referred to the *Conchology* as a joint work, sending coloured copies of parts 1 and 2 'as a present from us Editors'; but two months later he made it his own by dispatching 'No 3 of my History of Shells' (6 February and 4 April 1771, DC. Corr.). Unfortunately, no indication of authorship can be found in da Costa's own library catalogue, in which the only possible item is an undated 'New Conchology' with manuscript additions (DC. Lib., f. 7). Although this is reminiscent of his phrase 'a new anonymous Conchology' in the *Elements of conchology* (p. 51), the latter work is not listed and by 1781, when this part of the catalogue was drawn up, it could well have been dubbed as 'new' in contrast to the *Conchology* of ten years earlier. Johann Schröter, however, writing only a few years after the *Conchology* had appeared, attributed it to da Costa and made no mention of Humphrey (Schröter, 1774 : 15), while Chemnitz (1795 : 181) seemed to be in no doubt about the authorship when he wrote 'Da Costa, Conchology or Natural History of Shells'.

Perhaps the strongest evidence of da Costa's authorship (in the strict sense of having written the descriptions) comes from Humphrey himself. This is clearly proclaimed in a letter from Humphrey to da Costa proposing an addition to plate 12. He assures da Costa that this will not be inconvenient since 'it will be some time before you reach so far with the Descriptions' (1771, ? late July, DC. Corr.). This is further borne out in comments made by Humphrey many years later in a letter to John Timothy Swainson (cited in full by Jackson, 1937 – who wrongly gave William Swainson as the recipient; I am indebted to Nora McMillan for pointing out this error). The letter, dated 12 December 1815, contained a detailed list of the *Conchology* plates, with identifications and comments against each figure (thus most useful for those plates which lack a text).

By this time, Humphrey had established his reputation and had no hesitation in criticizing the *Conchology*. For plate 2, figure 3 he noted '*Scabrosa*. Rough. Country Mediterranean. Da Costa has omitted this in his Description' – and indeed the text for figure 3 has been completely forgotten; of plate 3, figure 10, Humphrey remarked 'DC. confounds it with the Common Limpet and European Auricula'; for plate 3, figure 12, Humphrey exclaimed 'How DC. came to call it the Thorny I can't conjecture'; for the 'Cracked Limpet' of plate 4, figure 2, Humphrey says 'I never saw any from Falkland Islands but a very small one, which is perforated at top' – whereas in the text of the *Conchology* the 'author' states categorically 'I have also seen very fine ones from *Falkland* Islands in the Atlantic Seas'.

Jackson (1937) made the curious mistake of assuming these comments to be directed, not at the *Conchology*, but at da Costa's *British conchology* (1778). As a result, Humphrey's remarks seemed quite consistent with his supposed authorship of the *Conchology*, whereas in fact they would be quite absurd, as Jackson would have realized immediately. However, Jackson was then able to assign authorship of the *Conchology* to Humphrey, largely based on Humphrey's phrase 'the Patella published by me' which appears at the beginning of the letter, together with the annotation 'Humphrey's Patella etc' on the back of J. T. Swainson's copy of the *Conchology*. Salisbury (1945 : 138–9) spotted Jackson's mistake and, realizing the contradiction between

Humphrey's comments and his supposed authorship, unhesitatingly gave authorship of the *Conchology* to da Costa.

Da Costa's authorship of the parallel French texts seems certain in view of the very similar translations that he made for Dru Drury's *Illustrations*. His close involvement in the project is quite clear from the letters between Humphrey and himself, many of which will be mentioned below in dealing with the dating of the work and its illustrations. Finally, if there was indeed an editor and an author, it is much more likely that the author was the one who could not admit to his authorship, while the editor was the one who was free to negotiate specimens and illustrations.

A case can also be made for considering the *Conchology* a joint work, in the sense of joint authorship. Da Costa, after all, was in prison and the book could not have been produced without outside help. Humphrey evidently organized the specimens and the illustrations and dealt with the publishers, sending da Costa at least one account of the sales (12 April 1772, DC. Corr.). The first intimation of a partnership comes in a brochure in French (in Humphrey's and not da Costa's writing) addressed to the Secretary of the Academy of Sciences in Paris, and it states:

> Nous avons l'honneur de vous envoyer les prémieres feuilles [Enluminées – added by da Costa] d'un ouvrage dont vous donnerons chaque mois un pareil nombre . . .

Below this da Costa added,

> Londres ce 20th Decembre de 1770
> Les Editeurs
> Chez Mons. Humphrey dans St Martin's Lane, près
> de Charing Cross, Londres

(20 December 1770, DC. Corr.)

This formula is also followed in a note, possibly in Humphrey's hand, at the top of parts 1 and 3 of one copy of the *Conchology* (provenance unknown) where it is stated: 'Presented by the Editors' (bound copy in British Museum (Natural History) with end papers but top of title page for part 2 trimmed off). Some years later, in the *Elements of conchology*, da Costa conferred authorship on these editors, saying that 'the authors have laid it aside' (da Costa, 1776 : 52).

Once again, this cannot be taken at its face value since the letters show that da Costa's involvement did not stop short merely at the descriptions. Of plate 4, Humphrey sent two proofs and in a strangely formal letter said that 'Mr DC. will be pleased to number and return [symbol for *per*] bearer' (2 October, 1770 DC. Corr.). Again, Humphrey deferred to da Costa's opinion on the identification of shells. The correct determination of the 'unperforated ear' has been mentioned earlier, but Humphrey also consulted da Costa on a dozen new species brought back from Captain Cook's first voyage (1771, ? late July, DC. Corr.). Even the choice of subjects for the plates was left to da Costa, Humphrey sending across various books and saying 'It lies with you to settle for the 8th plate which is to contain all the ears' (6 March 1771, DC. Corr.). Da Costa's responsibility for this is emphasized by Humphrey's later criticisms of figures copied from other people's works (letter to Swainson cited above).

Joint authorship could also be inferred from the slight stylistic difference between descriptions and the notes that follow, the former being impersonal in most (but not all) cases, the latter being in the first person. Thus, 'Mr Da Costa found them [a species of *Patella*] in great quantities . . .'. while in the note it says 'I do not find it described, or even mentioned, by any author' (text for plate 1, figure 10). On another occasion (plate 4, figure 13), the description says 'the only one in the British Museum', while the note reads 'In the same noble Collection I observed some small Limpets not above one Quarter of an inch long'.

In the face of Humphrey's own attribution of the descriptions to da Costa, one might suppose that the notes were afterthoughts added by Humphrey. This could be the case for the shorter notes, but there is some doubt in the case of the Black Limpet (plate 1, figure 8), in which there is a long and detailed criticism of Michel Adanson (1727–1806) and his synonymy of several species because of similarities in soft anatomy, regardless of shell characters. As noted earlier, Gray (1858) referred to Humphrey as a 'comparatively uneducated person' and Humphrey himself admitted in the Preface to the *Museum Calonnianum* sale catalogue that the editor 'hopes that his confession of being but little acquainted with the learned languages will be received as an apology for such improprieties in the generic or specific names as he fears will be found' (Humphrey, 1797 : v). On the other hand, Gray also found Humphrey 'far in advance of the state of natural history of his time' (Gray, 1858), while Swainson (1840b : 21–22) simply could not heap enough praise on Humphrey's arrangement of shells in the Museum Calonnianum: it was an 'entirely novel and very remarkable plan . . . a most extensive improvement upon everything of the kind which had hitherto been done . . . as far exceeds that of Linnaeus, as Lister's exceeds Klein'; and if that was not enough, he concluded 'As a purely conchological system, this was unquestionably the best and most original of any that had appeared since the revival of learning'. Whether this second Aristotle deserved such praise is a matter of opinion; da Costa, after all, was given the cognomen 'Plinius IV'. In fact, Dall (1889 : 301) gave the real credit for the *Museum Calonnianum* – or presumably the exhibition catalogue of 1788 on which it was based – to Christian Hwass 'whose manuscripts (by the aid of E. M. da Costa, an English writer on shells)' were then used by Humphrey. Although Iredale (1937 : 417) rejected this, pointing to the evident lack of the 'learned languages' shown in the catalogue, there is still the impression that the passage on Adanson in the *Conchology* is more consistent with the work of a man who went on to write two books on conchology than with one who merely published catalogues and a brief four-page note on the gizzard of *Bulla lignaria* (Humphrey, 1794).

Finally, it can be noted that the idea of the *Conchology* appears to have originated with da Costa. Two years before the Proposal was issued, Drury wrote to Pallas that 'Mr Da Costa is going to publish plates of nondescript animals – shells, Insects, etc. in periodical numbers, five plates with their descriptions being a complete number' (12 November 1767, Drury Corr.; also Cockerell, 1922 : 70). It seems likely that the *Conchology* stemmed from this larger scheme, being later pared down by force of circumstances.

Humphrey's role in the *Conchology* seems to have been more akin to that of an editor. Thus, he arranged for the illustrations to be done (perhaps paying for the artists), saw the book through the press, and kept a watchful eye on sales. Da Costa, on the other hand, probably conceived the project, certainly wrote the descriptions, made the French translations, chose some, if not all, of the species to be illustrated, identified material to be included, and collated the figures with the text. No doubt Humphrey put a lot of work into the book, but it seems reasonable to regard da Costa as its true author.

Illustrations

The *Conchology* has 12 plates, with between 11 and 27 numbered figures on each (or up to 33 actual drawings when shells are illustrated twice on the same plate). Henry Seymer had supposed that they could not have more than five shells on each plate, and if 26 genera with on average 50 species were to be figured, then a monthly issue of two plates would take nearly five and a half years; he advised an issue every fortnight and then 'persons almost of any age might hope to see the completion of it' (Seymer to Humphrey, 16 February 1771, DC. Corr.; also *Ill. Lit. Hist.* **4** : 773). The advice was not heeded and in any case four plates had already been issued by then.

The first four plates were signed 'J. Wicksteed Jun. del'. This was James Wicksteed (1718–91) from Dublin, who later worked in Bath and then London (Bénézit, 1966 : 736). He exhibited at the Royal Academy from 1779 to 1824 and is given by Graves (1906 : 263) as a gem engraver who showed mainly portraits (Wellington, Johnson, etc.). There is no mention of his name in the Humphrey/da Costa correspondence, but in a single letter of 1757 addressed to 'Mr James Wicksteed (Seal Engraver) at Bath' da Costa states that he had sent him a copy of the *History of fossils* and hopes that Wicksteed will oblige with a second half-guinea subscription for the remainder of the book (4 October 1757, DC. Corr.). Thus, da Costa had known Wicksteed for perhaps fifteen years and may have already approached him in 1767 when he planned the series of plates mentioned by Drury to Pallas.

If the plates were drawn in the order that they were published, then Humphrey's brother William was the second artist to be employed on the *Conchology*. William Humphrey drew for plates **5** and **7** and the first record of his involvement in the project comes from George Humphrey's application of 27 April 1770 for his brother to accompany him to the British Museum as his artist (Humphrey to da Costa, DC. Corr.). In asking da Costa to draft out this application, Humphrey had added 'Leave should also be asked for a person (my Brother) to be with me to draw any particular Shell' (April 1770, DC. Corr.). There is no indication in the letter why William Humphrey was employed at this stage or why he did not continue with the later plates. He was, in fact, an extremely competent mezzotint engraver and had already (1765) won the prize of the Society of Artists for an engraving after Rembrandt (Bénézit, 1966 : 29), but he exhibited only once at the Academy (as an Honourable Exhibitor in 1793 – see Graves, 1906 : 193).

The third and probably the best artist to work on the *Conchology* was Peter Brown, who later turned increasingly to flower paintings and became Botanical Painter to the then Prince of Wales (Bénézit, 1966 : 162). He exhibited at the Royal Academy between 1770 and 1791 and his address in the early 1770's was 'At Mrs Munt's milliner 16 Portland St.' (Graves, 1905 : 311). Among his earlier pictures were 'Two drawings of shells' exhibited in 1777, possibly originals from the *British conchology*, for which he did plates 1–2 and 4–17; they are referred to in a letter from Brown to da Costa requesting permission 'to Exhibit two of your drawings of shells, there is room for two, I think it would be an advantage to your Publication & would much oblige me' (16 April 1777, DC. Corr., the only Brown letter).

Plates 8 to 12 of the published parts of the *Conchology* are by Brown, but these well outrun the text, which stops short in the middle of figure 2 of plate 5; as Humphrey remarked to da Costa 'great fault' was found by Elmsley 'that the Figures exceed the Descriptions so greatly' (12 April 1771, DC. Corr.). In fact, Brown went on to draw four more plates, but these were never published. These four signed plates, together with the signed originals of plates 8 and 9, are now bound in with one and a half copies of the *Conchology* in the British Museum (Natural History). Brown was an excellent artist and the plates give little clue to the delicacy of his originals. A note in the book (in pencil) states 'Six loose plates added May 1929'. These drawings, which are on parchment, are probably part of the 'Ten original drawings on vellum by Brown (5 unpublished)' listed as Lot 86 on the thirty-sixth day of the *Museum Humfredianum* sale. In the Hope Department copy of the catalogue this lot (p. 168) is annotated 'DC for Dr Fothergill' and sixteen guineas was paid for it. John Fothergill's library and paintings were sold at auction by Leigh & Sotheby in April/May 1781, and the ten Brown drawings appear as Lot 72 on the eighth day. The annotated sale catalogue in the British Library shows that they were bought by 'Dobello' for eight pounds. This is probably a mis-writing for 'Rebello', who also bought an earlier lot, and would be the 'D. Alves Rebello' who was a member of the Society for Promoting Natural History (Linn. Arch.). I have been unable to find out when Rebello relinquished the drawings; they may have come to the British Museum (Natural History) through Alexander Reynell (Peter Dance, *in litt.*).

The plates of the *Conchology* were all engraved by Peter Mazell, an excellent engraver who worked also for Thomas Pennant and others and whose best work is probably seen in Cordiner's *Remarkable ruins and romantic prospects in North Britain*. Mazell was sympathetic to natural history subjects and himself exhibited two flower paintings at the Royal Academy in 1797 (Graves, 1906 : 220). He is only once mentioned by name in the Humphrey/da Costa correspondence, Humphrey saying that 'Mazelle has promised me the 7th plate next Monday' (12 April 1771, DC. Corr.).

It is disappointing that more cannot be gleaned of the history of the *Conchology* illustrations since the employment of a third artist by the time of the eighth plate could imply dissatisfaction over the first two artists or, conversely, their rejection of the contract because of the haste required or the lack of payment. There is a hint that Humphrey's brother was not satisfactory in a letter from Humphrey to da Costa in which he says that 'the Masks which are for the 7th plate . . . have been Drawn twice, tho' some of them must be redrawn' (6 March 1771, DC. Corr.).

Dating

Like many other works of this type and period, no dates are given on the parts of the *Conchology*. The title page is a wrapper of blue paper, of which those for parts 1 and 3 (two of the latter) are bound in with the coloured copies in the British Museum (Natural History); the wrapper for part 6 is in the British Library (Joseph Banks' copy, uncoloured, possibly inscribed but top of wrapper trimmed). Schröter (1774 : 156) seems to include 'à Londres 1771' in the title, but this is not printed on the wrapper. Authors since then have variously dated the work 1770–71 or 1771–72.

The most direct dating, unfortunately only of parts 1 and 3, is that inscribed on the wrappers of the incomplete copy in the British Museum (Natural History). The first reads 'Presented by the Editors Jan. 18, 1771' and the second 'Presented by the Editors [May 31 deleted] June 14 1771'. According to the wrapper, the work was to be issued in monthly parts containing two plates each. The text was obviously meant to keep pace with the plates, but it breaks off in the middle of plate 5 and the remaining six plates seem to have been issued without text.

The letters between Humphrey and da Costa in the British Library provide the only other method of dating the work. The result is shown in Table 1, which places the first five parts between December 1770 and August 1771, the sixth and final part presumably being later in 1771 but not in 1772. The earliest dates for each part can be summarized as:

Part 1, pls 1 and 2	20 December 1770	Part 4, pls 7 and 8	7 June 1771
Part 2, pls 3 and 4	6 February 1771	Part 5, pls 9 and 10	5 August 1771
Part 3, pls 5 and 6	4 April 1771	Part 6, pls 11 and 12	? October 1771

Part 2 followed part 1 after an interval of just over a month, but there was a delay over part 3 and da Costa must have taken Humphrey to task over this. The latter replied 'We are not in so bad a pickle as you imagine (tho' bad enough)' (6 March 1771, DC. Corr.). Thereafter, the parts appeared every other month, although the text had broken off in the third part at p. 26. Jackson (1937) supposed that Humphrey and da Costa quarrelled and thus the work was never completed, but according to da Costa (1776 : 52) the work was laid aside for lack of support. It remains now something of a literary curiosity and a record of how a once prominent man employed his time in a debtor's prison.

Table 1

Part 1 (plates 1 and 2, both by J. Wicksteed)	
20 Dec. 1770	First sheets to Paris (DC. Corr. **5** : 229)
18 Jan. 1771	'Presented by the Editors' (Brit. Mus. (Nat. Hist.) copy)
6 Feb. 1771	Coloured copy to Fothergill (DC. Corr. **4** : 163)
12 Apr. 1771	One plain and four coloured copies sold by Elmsley (DC. Corr. **5** : 232)
Part 2 (plates 3 and 4, both by J. Wicksteed)	
2 Oct. 1770	Two proofs of plate 4 to da Costa for checking (DC. Corr. **5** : 228)
6 Feb. 1771	Two coloured copies to Fothergill (DC. Corr. **4** : 163)
12 Apr. 1771	One plain and two coloured copies sold by Elmsley (DC. Corr. **5** : 232)
Part 3 (plate 5 by W. Humphrey, plate 6 by J. Wicksteed)	
24 Jan. 1770	W. Humphrey not yet begun drawings (DC. Corr. **5** : 223)
27 Apr. 1770	Application for W. Humphrey to draw shells at British Museum (DC. Corr. **5** : 227)
6 Mar. 1771	Plate 6 engraved, plate 5 in a week or eight days (DC. Corr. **5** : 230)
4 Apr. 1771	Three coloured copies to Fothergill (DC. Corr. **4** : 168)
14 Jun. 1771	'Presented by the Editors' (Brit. Mus. (Nat. Hist.) copy)
Part 4 (plate 7 by W. Humphrey, plate 8 by P. Brown)	
6 Mar. 1771	Plate 7 drawn, redrawn, but needs corrections; de Costa to choose subjects for plate 8 (DC. Corr. **5** : 230)
12 Apr. 1771	Plate 7 promised by engraver 'next Monday' (DC. Corr. **5** : 232)
18 May 1771	Forster asks if published (DC. Corr. **4** : 114)
7 Jun. 1771	Two copies to Fothergill (DC. Corr. **4** : 163)
Part 5 (plates 9 and 10, both by P. Brown)	
5 Aug. 1771	Forster has received copy (DC. Corr. **4** :117)
Part 6 (plates 11 and 12, both by P. Brown)	
late Jul. 1771	Humphrey to consult da Costa on contents of plate 12 (DC. Corr. **5** : 231)

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While this paper was in press, I received a typescript with almost the same title and conclusions by Nora McMillan; with great generosity she withdrew her work and allowed me to use several further references that I had overlooked.

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The Forster collection of Zoological drawings in the British Museum (Natural History)

P. J. P. Whitehead

Historical series Vol 6 No 2 30 March 1978

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The Forster collection of zoological drawings in the British Museum (Natural History)

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Abstract

Almost all the natural history drawings made by George Forster (1754–94) on Captain Cook's second voyage around the world are now in the British Museum (Natural History). The two zoological volumes contain 33 drawings of mammals, 140 of birds, 3 of reptiles, 81 of fishes and 14 of invertebrates, of which 191 are variously completed in watercolour and 80 are pencil sketches. The drawings, for the most part unpublished, are an integral element in J. R. Forster's *Descriptiones animalium* (1844).

The bird drawings have already been catalogued by Lysaght in an earlier volume of this Bulletin (1959). The remainder are listed here, with all annotations, references to the *Descriptiones animalium* and citations from a contemporary list and from a notebook of George Forster's observations. In addition, the 26 gouaches in a series at Gotha are listed, as well as the 6 watercolours at Weimar and 2 at Jena.

Introduction

Early zoological and botanical drawings are often essential to the identification of Linnaean and subsequent names because of inadequate original description and/or absence of type-specimens. For this reason, the many hundreds of drawings of animals and plants made on Captain Cook's three voyages, almost all of which are now in the British Museum (Natural History), are fairly frequently examined in order to settle taxonomic or nomenclatural problems. Relatively few of these drawings have ever been published, yet many are virtual if not actual iconotypes.*

The largest series of natural history drawings from Cook's voyages is that by Sydney Parkinson (1745?–71), natural history artist on the first voyage (1768–71); it comprises 18 botanical and 3 zoological volumes. Smaller, but equally important is the collection of drawings made on the second voyage (1772–75) by Johann George Adam Forster (1754–94), son of the official naturalist on the voyage, Johann Reinhold Forster (1729–98); the Forster collection comprises 2 botanical

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* *Iconotype:* strictly, an illustration that formed the *sole* basis for a new species name, not necessarily with a verbal description unless the illustration remained unpublished. An illustration is based directly or at one or more removes on a specimen, but if this or another specimen was used by the author of a new name, then the illustration is not an iconotype but merely an extension of the description. Nevertheless, where type-specimens have not survived, then their illustration, whether published or not, has great importance. Although not in the strict sense semaphorants (i.e. name-bearers), such illustrations often provide more easily interpreted information than many an early verbal description. In this respect, an original drawing is usually superior to a published one, hence the continued value of early drawings to taxonomy.

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and 2 zoological volumes. Fewer natural history drawings were made on the third voyage (1776–80), but they include a small volume of 115 drawings by William Ellis (1735?–85). These Parkinson, Forster and Ellis drawings are in the British Museum (Natural History), but there are also a few natural history drawings in the Department of Prints and Drawings at the British Museum, including 46 by John (William) Webber (199* b 2) and a few by John Cleveley, John Frederick Miller and James Miller (bound together, 199* b 4).

The natural history drawings from the Cook voyages were formerly in the possession of Sir Joseph Banks (1743–1820). Together with the Banksian collection of books, manuscripts and specimens, they passed to the British Museum in 1827 and they were amongst the Banksian and other natural history drawings that in 1881 were transferred (with a few exceptions) to the newly founded British Museum (Natural History) at South Kensington.

There is no published catalogue of all the natural history drawings from the Cook voyages. For zoology, the nearest approach is that by Lysaght (1959) in her excellent study and listing of all the Banksian bird drawings. An account of Parkinson's zoological drawings from the first voyage was given by Sawyer (1950) and some useful information on George Forster's zoological drawings was given by Steiner & Baege (1971) and also by Joppien (1976). Albert Günther drew up lists of all the fish drawings in the Parkinson and Forster volumes and these lists are now kept with their respective volumes. More important, however, are five contemporary lists of Banksian natural history drawings, the most complete being that made by Jonas Dryander (1748–1810), Banks' second librarian. These lists are of great interest because they were based on information that seems to be no longer available, such as the attribution of 9 first voyage drawings to Herman Diedrich Spöring (1740 ?–71), assistant and amanuensis to Banks on the voyage (7 fishes, 2 crabs). The lists also contain information that must have been supplied by the Forsters, of which the original document is no longer extant. The main Dryander list was used by Lysaght (1959) and all were briefly enumerated by Whitehead (1969a : 186–187); they will be described in more detail below (see p. 31).

The natural history observations made by George Forster during the early part of the voyage are contained in a notebook now in the Bibliothèque Centrale of the Muséum National d'Histoire Naturelle in Paris. Some of the observations are relevant to the drawings listed here and will be discussed below (p. 34).

The catalogue of the Forster zoological drawings given here is a further contribution to the growing literature on J. R. Forster and his son George. The latter has been well served by an East German Forster-Ausgabe justifiably determined to make a hero, resulting in a multi-volume work on his life, writings and letters (Steiner, 1971; see also Kahn *et alii*, 1972 etc.). George has always stolen the limelight, but J. R. Forster, maligned and underrated for much too long, has now been rehabilitated in a full, detailed and superbly documented biography by Michael Hoare (1976). Much information can be mined from Steiner and from Hoare on the circumstances of the voyage and the production and fate of the drawings, and the value of this is enhanced by the publication of J. R. Forster's manuscript *Journal* of the voyage, in which day-to-day zoological and botanical discoveries are noted (Hoare, in press). Thus, the taxonomist has quite a range of primary and secondary material with which to explore Forster's descriptions of animals.

Descriptiones animalium

The value of the Forster drawings is still immense. Few have ever been published, yet they frequently provide the best means of identifying the species described by Forster or by later workers who used Forster's manuscripts. The zoological drawings have a particular importance because specific reference is made to them in Forster's original descriptions of the animals seen during the voyage, many of which were described and named for the first time. Unfortunately, Forster's descriptions remained in manuscript during his lifetime, being in the form of three quarto and one folio volume (I, 98 ff – from August 1772; II, 134 ff – from July 1773; III, 135 ff – from April 1774; IV, 86 ff – from December 1774). These four volumes were subsequently acquired by the Königlichen Bibliothek (later Preussischer Staatsbibliothek) in Berlin and after the last war were among the manuscripts eventually deposited in the Staatsbibliothek Preussischer

Kulturbesitz at Dahlem in West Berlin (Ms Lat. qu. 133–136); Forster's manuscript *Journal* is also in this library (Ms germ. qu. 222–227).

Forster's manuscript descriptions were seen and the ichthyological portions used by J. G. Schneider (1801) for his *Systema ichthyologiae*, where they were cited by volume and page number (but the drawings not seen). It was not until some seventy years after the voyage that the Forster descriptions were published, being edited by M. H. K. Lichtenstein (1844) as *Descriptiones animalium*. By this time, many of the species were no longer novelties, having long since been described by Schneider and others, often as a result of further material brought back from the Pacific. Lichtenstein was faithful to Forster's text, merely adding an asterisk and footnote when the species had already been given a name. His additions on the manuscript were made in red ink. They also include a serial number for each species, but there are a few errors in the numbering; 34 is missing and *Perca lepidoptera* is not numbered. In the published text there is also a carelessness over numbers; 102 is omitted, two species are not numbered (pp. 363, 388, although the latter is merely a variety or subspecies), while male and female are sometimes numbered separately and sometimes not. Forster occasionally had a change of mind over the name of a species, but in at least one case it appears that the Forster name has been crossed out and Lichtenstein has added another (vol. IV, f. 12 – *cyprinoides* for *setipinna*).

For the majority of species there is a reference by J. R. Forster himself to a drawing, cited as 'Fig. pict. G.' etc., and it is clear that the making of a drawing was an integral part of the process of description. According to the *Descriptiones animalium*, drawings were made for 16 out of 46 species of mammals described, 121 out of 160 species of birds, 1 for the only species of reptile, 67 out of 86 species of fishes, and 5 out of 13 species of invertebrates, making a total of 211 species drawn out of 306 described. This does not take into account species merely mentioned by name, for which no indication of a drawing is given although such in fact exists. Only a few of the earlier drawings are stated to have had a number, given as Fig. picta A.1, 2, 3, 4, 5, 6, then x (twice), then A alone, then x alone, thereafter nothing. However, almost all the drawings can be related to a description by virtue of a name and/or locality and date written on the drawing. The drawings would have been better known and used had Lichtenstein added the number of each drawing.

The *Descriptiones animalium*, although fairly widely used by nineteenth-century zoologists, has suffered from several disadvantages. The narrative sections, as well as the descriptions and Lichtenstein's introduction, are written in Latin. Again, the arrangement is chronological and not systematic and although there is an index, the names are keyed to generic allocations that are not easily recognizable to modern workers; in any future reprint edition the provision of an index to species names, as well as a table of contents arranged systematically, would be a help. The most serious drawback is the lack of illustrations, for the drawings have hardly been used by non-British zoologists until comparatively recently. For these reasons, and because of the delay in publication of the text, J. R. Forster's most important contribution to zoology has not reaped the credit that it deserves.

The drawings

The Forster collection contains 33 drawings of mammals (Nos 1–31), 140 of birds (Nos 32–168), 3 of reptiles (Nos 169–171), 81 of fishes (Nos 172–251) and 14 of invertebrates (Nos 252–261), making a total of 271 drawings (some folios given as a and b). Some species are represented by more than one drawing and there are also a number that are not formally described in the *Descriptiones animalium*, hence their added importance. The total might seem small for three years' work, but Hoare (1976 : 104) has pointed out that only 290 days, or just over a quarter of the voyage, was actually spent at anchor or on short landings, so that the Forsters were hard put to collect, record, preserve, describe and draw the wealth of material that they discovered. In addition, one should not forget the botanical collecting and the tedious pressing of specimens, nor the 301 drawings of plants made by George Forster. Forster's *Journal* gives a graphic account of the wet and cramped conditions of their cabin (see Hoare, 1976 : 87–88) and it is clear that careful draughtsmanship was more easily achieved on shore.

Most of the drawings seem to have been made on the spot and while the material was fresh, but a few were evidently worked up afterwards. For example, Lysaght (1959 : 299) noted four bird drawings that are dated after the *Resolution* had left the Cape of Good Hope (Nos 112, 115, 116, 129) and she concluded that they must have been completed at sea.* Despite the conditions on board, it is still a little surprising that more of the zoological drawings were not worked up in the intervening periods. Only 155 of the drawings can be considered complete, 36 have some colour added (often little more than an indication), but 80 are mere pencil sketches (occasionally with ink or brown crayon as well). Only very rarely did George Forster write an indication of the colours on the drawing, so that it is hard to see how they could have been worked up later (which was surely the intention).

Backgrounds are supplied for a few of the drawings (14 birds, 6 mammals). For the mammals, this usually takes the form of a little hillock on which the animal stands, the colour being beige or brown with rather sharp and dark shadows. For the birds there is often a low and sloping foreground with small and curly lines of green or brown to suggest vegetation, but in two drawings there is a complete background of land and sky (Nos 32, 133), while in some of the sea birds there is an indication of water and sky (e.g. Nos 86, 89). In some of the pencil sketches there is a tentative background (e.g. Nos 39, 90, 120, 143). The number of unfinished drawings suggests that George Forster had no time for such embellishments and he probably also lacked the skill.

The drawings are on fairly heavy cartridge paper, originally of varying sizes but now mounted onto sheets that are trimmed to 64·6 × 46·0 cm, the paper being cut to expose both sides of the drawing. Occasionally there is a pencil sketch on the verso (e.g. No 191 *Perca grunniens*).† The annotations are almost always on the recto, but occasionally there is a note on the verso (e.g. No 32 *Falco serpentarius*, No 2 *Phoca antarctica*).

The name given to the animal is usually written in pencil immediately below the subject, presumably by George or his father when the description was complete and a name found; the generic name is sometimes in capital letters (of which a few are in ink) and the species name that follows it was probably added later. In many instances another species name follows the first or is written above it, with or without deletion of the first but often with an indication of the source of the name (e.g. *Bos Connochaetes* Mas., followed by *Antilope Gnu* S.N. XIII : 189, n. 25, being a reference to the 13th edition of Linnaeus' *Systema naturae* of 1788–92). Some of the other additional names are qualified by 'Brouss. Ichthyol.', being a reference to Pierre-Marie-Auguste Broussonet (1761–1807), who visited England in 1780 to work on fishes at Banks' house and at the British Museum and whose published *Ichthyologia* appeared two years later (Broussonet, 1782). Yet another source for names is 'MS Brit. Mus.' or merely 'MS'. This may refer to the manuscript descriptions begun by Daniel Solander (1733–82) as a result of his participation on the first Cook voyage and thereafter expanded, on little slips of paper, to cover the entire plant and animal kingdoms for a revised edition of the *Systema naturae*. Solander's zoological notebooks and slips, all now at the British Museum (Natural History), were listed by Whitehead (1969a : 185). In a few cases an addition to a drawing is followed by the initials 'JB' for Joseph Banks (e.g. No 232 *Salmo myops*, where the native name Erai is added).

The principal name on the drawings is usually that also used in the *Descriptiones animalium* and must have been written at the time. The references to the *Systema* must have been written after 1788–92, when Solander was dead and the Forsters were in Germany; they may have been written by Dryander, but perhaps by Latham, Pennant or other zoologists who studied the drawings. The Forster drawings were bought by Banks for 400 guineas in August 1776 (see Forster to Banks, 9 August 1776 in Dawson, 1958 : 339) and it is unlikely that J. R. Forster subsequently annotated them since he did not also change the names in the *Descriptiones animalium*. He left England in July 1780 and probably did not meet Broussonet, who in any case could not have worked through all the drawings by then. Thus, the references to the *Ichthyologia* were either by Broussonet himself, or more likely, by Solander who, as Banks' first librarian, would have had the drawings readily available.

* Four of the botanical sketches made at Madeira in August 1772 are stated on the completed drawing to have been painted in February and March 1773, shortly before the ship reached New Zealand (Nos 45, 172, 175, 201).

† Most of the botanical drawings have been pasted directly onto sheets, but on the verso of four drawings where this is not so there are the beginnings of a pencil sketch of a bird (Nos 18, 78, 82, 154).

The other annotations on the drawings include the locality and date, presumably made at the time (bottom right); very occasionally a note on provenance or colours (bottom left or centre); a native name, with diacritic marks to show pronunciation (usually bottom left or centre, occasionally at the top); a reference in the case of fishes to Schneider's *Systema Ichthyologiae* (e.g. 'Schn. 178' – bottom left or right); a reference in the case of birds to John Latham's *General Synopsis of birds*, 1781–86 (with or without a reference also to the *Systema Naturae*); and finally, in ink, the name 'Ge Forster' written by Dryander (extreme bottom left, but sometimes partly or completely trimmed off).

The drawings are now arranged systematically and numbered 1–261 consecutively through the two volumes (top right). It is not clear if they were in this order when Banks received them or at what date they were numbered and bound. Possibly they were still loose and in folders when Lichtenstein edited the *Descriptiones animalium*, hence he could not cite drawing numbers.

The artists

Nothing is known of George Forster's artistic training, but he seems to have had a natural talent for drawing that was reinforced by whatever encouragement he received from his brief periods at school or from his father. However, his ability to draw seems to have been decisive in the Admiralty's appointment of him as official natural history artist on the voyage (see Steiner & Baege, 1971 : 53). Anders Sparrman (1748–1820), the naturalist who was engaged by J. R. Forster at the Cape, later wrote envying George his 'drawing hand' (T. Forster, 1829 : 675).

The earliest drawings from the voyage, dating from August 1772 when George was not yet eighteen, show good observation and neat draughtsmanship. As the voyage progressed, one gets the impression that the pencil work becomes surer and more fluid, although even at the Cape of Good Hope (30 October–22 November 1772) the several pencil sketches of a gnu drawn from life are bold and at times fully confident. On the other hand, his finished and fully coloured mammal drawings from the Cape are often small, restrained and even a trifle wooden, in striking contrast to some (but not all) of his finished and coloured bird drawings. Aesthetically, his most pleasing drawings are the large pencil sketches or the drawings of sea birds where only a wash of colour has been applied. He rarely used pen and ink, but one botanical drawing (No 60) shows that he was quite confident in this medium.

Over half the drawings are of birds and a third are of fishes, and in these groups he drew three-quarters of all the species described. Although the zoology of the voyage was dominated by birds and fishes, as can be seen from the descriptions, there was still plenty of scope for invertebrate studies. In fact, only 13 invertebrates were described, of which 5 were said to have a drawing, and there are 14 invertebrate drawings. To some extent this may have reflected J. R. Forster's interests and thus his instructions to his son; certain invertebrates, such as crabs, molluscs and insects, could be fairly easily preserved and drawn later, but the paucity of descriptions suggests that this was not the intention. To judge from the success of the drawings, it would seem that George was happiest with birds, interestingly-shaped fishes and plants, excelling at lines and contours but lacking the facility for colour-work so evident in Parkinson's drawings from the first voyage.

Two of the early drawings (Nos 254 *Doris laevis*, 259a *Medusa pelagica*) are signed with a pencilled monogram 'GF'. There are also a number of bird drawings, all with a foreground sketched in colour and dating from the stay at the Cape, which also have this monogram (Nos 112, 115, 116, 118, 129).* Thereafter, the drawings are unsigned, but while most are clearly the work of George Forster, there were in fact other hands at work.

Lichtenstein (1844 : XIII) seems to have been the first to point out that the formula 'Fig. pict. G.' is not invariable in the *Descriptiones animalium*, being replaced sometimes by 'Fig. pict. F.'. The first, he stated, referred to 'Georgium filium', while the second 'vero Forsterum ipsum significat'. There are 7 cases of 'Fig. pict. F.' (fishes Nos 191 recto and verso, 229, 231, 241 lower; mammals Nos 17, 18a). All are pencil drawings and although quite competent lack something of the artistic flourish of his son's drawings. The earliest is a fish drawn at the Cape Verde Islands in August 1772, while the two mammal drawings were done at the Cape two months later. Possibly J. R. Forster did these to show his son what was required of a scientific representation. He seems to have attempted no more drawings until their visits to Tahiti and Tanna in mid-1774, when he drew four more fishes, possibly because of pressure of time. In two cases (Nos 241 lower *Trigla asiatica*, 191 verso *Perca grunniens*) George later made a neat copy, probably traced (Nos 241 upper, 214). In three further cases the drawings are given a joint attribution as 'Fig. pict. F. et G.' (fishes Nos 196 *Harpurus nigricans*, 183 *Blennius gobioides*; bird No 162 *Motacilla seticauda* – all 1774). Presumably, J. R. Forster made the original drawing, which was finished and coloured by George.

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* Nine of the finished botanical drawings are signed in this way (Nos 5, 45, 103, 108, 120, 156, 172, 175, 201). All of them seem to have been completed in New Zealand or shortly before their arrival there in March 1773.

Another indication, given twice in the *Descriptiones animalium*, is 'Fig. picta Schum.' and 'Fig. picta Schumacher', which refers to three bird drawings (Nos 69 and 70 *Anas montana* ♀ and ♂, 115 *Ardea palearis* – all from the Cape). It was argued by Lysaght (1959 : 299) that since the last drawing has George Forster's monogram on it 'we can scarcely doubt that he was the artist'. However, there is no reason why George should not have finished off the drawing and, in conformity with the other bird drawings from the Cape, have put his name to it. I have been unable to find any contemporary reference to the name Schumacher in the documents examined and Lysaght (1959) seems to have had no success either. However, in Catalogue B (see below, p. 32) there is a note against *Anas montana* which states that 'Mr Forster has a drawing in colour made by a [word begun but deleted] soldier at the Cape'. This evidently refers to Schumacher, who was perhaps an amateur naturalist and artist and possibly a friend of Sparrman's. In fact, a Johannes Schumacher is listed as a Cape artist in the period 1776–77 by Gordon-Brown (1952 : 117) and it is said that 56 out of 66 of his pictures in the Swellengrebel Collection at Breda have been reproduced. This must surely be the same man.

A third and most interesting attribution in the *Descriptiones animalium* is the single reference to 'Fig. pict. Hodges', which refers to drawing No 109 *Larus scopelinus*, described on 13 April 1773 at Dusky Bay, New Zealand. This was evidently drawn by William Hodges (1744–97), official artist on the *Resolution* for landscapes and people. For several reasons this picture is significant.

In the first place, this Hodges drawing emphasizes an already documented case of cooperation between George Forster and Hodges, for on another bird drawing (No 32 *Falco serpentarius* from the Cape) Dryander has written on the verso 'Ge. Forster. the background by Hodges'. This is not stated in the *Descriptiones animalium*, but a note in Catalogue B reads 'The Background by Mr Hodges', which is certainly a statement originally made by either J. R. or George Forster. Joppien (1976 : 10) has argued cogently that this may not have been the only occasion when Hodges supplied a background, since in another Cape bird (No 133 *Otis afra*) there is a stylistically almost identical background; unfortunately, there is no confirmation of the latter in Catalogue B. Joppien goes on to suggest that the little hillocks for some of the Cape mammals (Nos 17 *Antelope tragulus*, 18b *Antilope pygarga*, 29 *Antilope oreotragus*) seem to 'exhibit landscape elements in Hodges' familiar style', while the skies in some of George's sea bird drawings also bear a close similarity to those in Hodges' paintings.

Secondly, this drawing by Hodges suggests that the latter, ten years older than George Forster and an experienced draughtsman, took an interest in the boy's work and could well have offered him advice, the drawing perhaps being by way of illustration. In fact, the drawing could well be mistaken for one of George's later drawings of sea birds, so that perhaps he was influenced to adopt this large and rather vigorous technique.

A third point of interest is the bearing that this Hodges' drawing may have on J. R. Forster's inclination to defend his son's natural history territory. George seems to have got on well with Hodges, but in his subsequent account of the voyage he commented a little scathingly that the print from Hodges' drawings of Christmas Sound contained a falcon in the foreground that 'from its supernatural size, seems to resemble the rukh, celebrated in the Arabian tales, more than any bird of less fanciful dimensions' (G. Forster, 1777, **2** : 494). William Wales, astronomer on the *Resolution*, seized on this in his *Remarks* and used it also as a means to sneer at J. R. Forster's treatment of so affable and polite a man as Hodges, alluding to an occasion when

> Mr. Hodges had once before . . . experienced the Doctor's *candour* and *politeness*, on attempting to draw a penguin for his amusement, or, perhaps, for his improvement; I am verily persuaded it was not with any design to *rival* Mr. George Forster. (Wales, 1778 : 99)

In George Forster's *Reply* to Wales' *Remarks*, he allows 'great merit' to Hodges as a landscape painter 'but I think too well of him, to be apprehensive, that he will lay a claim to anything more' (G. Forster, 1778b : 39). George was also critical of Hodges' figure work (G. Forster, 1777, **1** : 427), but the context in the *Reply* is surely natural history. However, the fact that J. R. Forster gave credit to Hodges in the *Descriptiones animalium* argues that the Doctor, although careful to preserve his son's official position, was quite prepared to acknowledge a contribution by Hodges. One gets the impression that George, while heeding his father's insistence of scientific accuracy, saw no reason why Hodges should not sketch in a background or offer advice.

Finally, this Hodges drawing, as well as the backgrounds in the other drawings, can be seen in relation to the presentation set of gouaches on parchment which were copied after the voyage from George Forster's drawings and intended as a gift for George III. Only 'about thirty' of these copies were completed before the offer was rejected by the king, but by then George Forster claimed that a hundred guineas had been paid 'to employ a painter to copy my sketches' (G. Forster, 1778a: 7). These gouaches were eventually sold in 1781, through the good offices of no less a person than Goethe, to Duke Ernst II of Saxe-Gotha-Altenburg for eighty louis d'or. The story is documented by Steiner & Baege (1971 : 63), who showed that 24 of these presentation gouaches are now in the Gotha Forschungsbibliothek (2 mammals; 20 birds, which they reproduce as pls 1–20; and 2 fishes). Two other gouaches, formerly part of the Gotha collection (bird, fish), were sold in 1936 and were on sale again in London forty years later (Joppien, 1976 : pls A, B). In addition to the gouaches, the Gotha library also acquired 6 botanical drawings on paper, possibly part of the collection sold by George Forster's widow Therese to Duke Ernst II in 1797 (Steiner & Baege, 1971 : 66, note 47). There are also six Forster drawings on paper at the Schlossmuseum der Staatliches Kunstsammlung in Weimar (KK 499–504 – all birds, of which three match pls 2, 3, 7 in Steiner & Baege, the fourth is their pl. 23, and two are European birds). In addition, there are two drawings of penguins in the Universitätsbibliothek in Jena (Steiner & Baege's pls 21, 22). A list of all these drawings is given here (p. 46).

The artist employed to make the gouaches has never been identified and his (or her) name was not found by Hoare in all the manuscript and published material that he examined. Joppien (1976 : 10–11) has drawn attention to the stylistic difference between the subjects (very finely painted) and the backgrounds (much broader treatment, sometimes carelessly overlapping subject or frame), and he noted that the backgrounds had much in common with Hodges' known style, as well as with some of the backgrounds referred to here. It would seem very reasonable that the Forsters should ask Hodges to lend an authentic touch to the backgrounds since the latter had made numerous studies for his own purposes. The subjects, on the other hand, are very far removed from Hodges' style, at least to judge by the single bird drawing, and he was surely not the copyist employed. However, there were in London a number of talented natural history artists who would have been glad of such employment. E. M. da Costa, for example, had employed William Humphrey, John Wicksteed and Peter Brown a few years earlier to draw shells (Whitehead, 1977) and there were men like John Frederick Miller, Peter Paillou, Frederick Nodder and others who would have welcomed both the money and the prestige of such a commission.

Although George Forster in no way rivals such masters of natural history drawing as Paillou, Nodder and the Bauer brothers, his achievement is remarkable considering his youth, lack of training and eventual career as a literary man. His father's drawings are careful, even hesitant, as befits a scientific man; by contrast, the best of George's are accurate but vigorous and assertive, as if presaging the scale on which his future literary talents would roam.

Banksian catalogues of drawings

Since Banks' residence at 32 Soho Square served virtually as a natural history museum (and certainly had one of the finest natural history libraries in the country), Banks himself seems to have been very conscious of the need for catalogues. Dryander's monumental *Catalogus biblio-*

thecae historico-naturalis (1796–1800) has brief references to some of the series of drawings in Banks' collection (Forster drawings in vols. **2** : 17 and **3** : 69), but there are five contemporary manuscript catalogues now in the British Museum (Natural History) which list the zoological drawings from the Cook voyages. The first and most comprehensive is by Dryander, the second (dealing only with the Forster drawings) is probably by Solander and the third is an abbreviated version of the second; the fourth, by Dryander, deals only with the third voyage, and the fifth lists specimens related to drawings from the second and third voyages.

Catalogue A

MS. Catalogue drawings of animals Dryander (on spine)

Title page: J. Dryander's manuscript catalogue of the drawings of animals in the library of Sir J. Banks arranged in systematic order (ink)

251 ff (numbered), 32·5 × 20·3 cm, BMNH., Zoology Library, 89 f d.

A second (unnumbered) page gives an alphabetical list of abbreviations used for localities, as well as a list of six symbols used against each entry to denote the state of the drawing, i.e. finished, with (×) or without (+) colour; sketch, with (/) or without (–) colour; copy upon transparent paper (○); from a spirit preserved specimen(s).

The entries are arranged systematically, apparently following the 12th edition of the *Systema naturae* (1766). Each entry begins with a symbol of its state, followed by the name of the animal and author (but in many cases a generic name only), the abbreviated locality, the artist, and finally in some cases a literature reference.

Attributions are made to the following 37 artists: P. d'Auvergne, J. Backström, Barnes, Bolson, P. Brown, A. Buchan, J. Cleveley, N. Dance, T. Davies, G. Edwards, W. Ellis, Engleheart, G. Forster, F. Frankland, S. Gilpin, J. Greenwood, W. King, G. Metz, J. Miller, J. F. Miller, U. Mole, F. P. Nodder, P. Paillou, S. Parkinson, Chev. Pinto, Roberts, J. van Rymsdyk, A. Schouman, J. E. de Sève, J. Sowerby, Spalding, H. Spöring, J. Stuart, G. Stubbs, W. Watson, J. Webber, G. Wright.

Both Hodges and Schumacher are absent from this list, which suggests that the Forster and other drawings were in folders and Dryander merely took the names from the folders without consulting a list such as the Forsters must have supplied. This is further borne out by the absence of a locality for certain Forster drawings, even though such is entered on the list given in Catalogue B. Dryander had presumably forgotten or felt that it was unnecessary to mention Hodges' contribution to the background of one Forster drawing.

Catalogue B

M.S. Catalogue of Forster's drawings, Cook's 2nd voyage, 1772–75. (on spine)

Title page: nil

28 ff (numbered), 32·0 × 20·0 cm, BMNH., Zoology Library, 89 f F.

The entries are arranged systematically (approximately the same as in Catalogue A). Each entry has the name of the animal, followed by the locality and below this often the common name and a size indication (most often 'Nat. Size'); below this again there are sometimes notes or 'Obs.'.

The list was not written by either J. R. or George Forster since the former is referred to in the third person, e.g. 'Mr Forster has a drawing in colour . . .' and 'The largest Mr Forster saw . . .'. The writing closely resembles Solander's, but the list appears to have been carefully copied from one supplied by the Forsters.

The list refers to 19 mammals, 127 birds, 3 reptiles, 75 fishes and 14 invertebrates. In some cases more than one drawing is noted, so that the totals are not far short of those of the existing drawings.

The notes are a useful supplement to the data written on the drawings (locality, size, colour). Occasionally there are comments on the method of capture, habits, habitat and the accuracy of the drawing. References to Hodges and Schumacher in this list have already been mentioned (see above, p. 30). Extracts from these notes have been included here where they add data not on the drawing.

Catalogue C

[Bound in immediately after the preceding]

Title page: nil

21 ff (numbered), same size, etc. as before.

The first page has a pencil note across the top 'Catalogue of drawings of animals collected on Cook's 2^{d} voyage by Geo. Forster'.

The entries are in the same hand as in the previous list, but they are arranged in a slightly different order. Each entry is preceded by a symbol (ticks in one column, crossed dashes in another), followed by the name of the animal and an abbreviation for its locality. The ticks and dashes seem to have been crossed off as if compared with another list or with the actual drawings themselves.

The list refers to 19 mammals, 132 birds, 3 reptiles, 76 fishes and 14 invertebrates; it appears to be directly related to the previous list, the one being derived from the other, or both from the same source.

Catalogue D

Unbound

Title page: (not contemporary) MS. Catalogue of the Birds and Fishes in the Drawings of J. Webber and W. W. Ellis, made during Capt. Cook's third voyage round the World, 1776–80, with descriptions and localities.

11 ff (pages numbered), 32·3 × 19·3 cm, BMNH., Zoology Library, 89 f S Sol. Z.6.

The first part (pp. 1–16), probably by Dryander, contains 161 numbered entries (and some additions) dealing with birds and 2 mammals. For each is given the number of specimens, the artist, the name of the species and its locality. There are listed 92 Ellis drawings and 37 by Webber, being those respectively in the British Museum (Natural History) and the British Museum, Department of Prints & Drawings (see above, p. 26).

The second part (pp. 17–22), possibly by Solander, contains diagnoses and lists of species for three fish genera (*Labrus*, *Perca* and *Sparus*).

Of specimens listed in the first part, there are 220 birds and 3 mammals, presumably then in Banks' collection.

Catalogue E

Unbound

Title page: 4 MS. Catalogues of the Birds in the Drawings of J. G. A. Forster & W. W. Ellis [& Webber] from Capt. J. Cook's second voyage, 1772–75, and third voyage 1776–80.

24 ff (in four parts, each numbered separately), 32·3 × 19·3 cm, BMNH., Zoology Library, 89 f S Sol. Z.3.

Part 1. 15 ff (numbered), containing 185 numbered entries giving the name of a bird, a brief Latin diagnosis, usually a locality, sometimes a reference as 'Sol. Cat.' to the number of the species in Catalogue D, and finally a number (up to 5, probably being the number of specimens). The first page is headed 'Birds taken from the last voyage to be carried to the end of the Kingfishers'. A whole page containing Nos 115–121 is missing, but these can be found in Part 2 (which is in the same order).

Part 2. 5 ff (10 numbered pages), containing 121 numbered entries (as in previous list).

Part 3. Single page, virtual repeat of the above but with extra entries 1a, 5a, 6a, 6b, 8a.

Part 4. 3 ff (pp. 4 and 5 numbered), containing 65 entries, similar to the previous lists but the order different.

These appear to be lists, in Dryander's hand, of bird specimens in Banks' collection, not only from the second and third Cook voyages but also from Banks' voyage to Newfoundland and Labrador in 1766 and from Masson's journeys in South Africa in 1772–76.

In addition to these five catalogues, there is a fourth which is a small notebook (17·5 × 11·5 cm) kept with the others and containing a list of all the Parkinson, Forster and Ellis bird drawings in the British Museum (Natural History). Each entry contains the drawing number, locality and name used for the bird by Latham, Gmelin and Forster (and occasionally also by later authors). The paper is watermarked 1859 and the list may have been compiled by J. R. Gray since an incomplete catalogue of his papers occurs at the end, together with a note on exchanges of specimens with the 'Warsaw Museum' in 1874–75.

George Forster's *Observationes*

The Bibliothèque Centrale of the Muséum National d'Histoire Naturelle in Paris possesses a small notebook (MS. 189) in which George Forster wrote day-to-day notes on the animals and some plants seen on the voyage in 1772 and during their stay at Dusky Bay (26 March–11 May 1773). The book is 18·1 × 11·7 cm and the title page reads:

> Observationes / Historiam Naturalem / Spectantes / quas / in / Navigationes Terras Australes / instituere / coepit / G.F. / Mense Julio, Anno CIƆIƆƆLXXII

The earlier pages are numbered 1–54 (55–72 missing), 73, then 74–101 unnumbered, followed by two further unnumbered pages written in pencil (species 'in insula Ulietea'; not examined). The itinerary is paged in the following manner:

p. 1	13–22 July 1772	Bay of Biscay
p. 2	24 July	Between Spain and Madeira
pp. 3–9	30 July–1 August	Madeira
p. 10	2–13 August	Madeira to Cape Verde Islands
pp. 11–15	14–16 August	St Jago
pp. 16–41	17 August–30 October	St Jago to Table Bay
pp. 42–53	22 November–1 January 1773	Table Bay to Antarctic waters
p. 54 (blank)		
pp. 55–72 (missing)		
pp. 73 [74–101]	26 March–3 May 1773	Dusky Bay

The notes are written in English up to p. 54 and contain mostly fairly brief observations on species seen, sometimes with data or even species not given in the *Descriptiones animalium*. The longer notes are usually concerned with birds, as for example the swallow that George befriended and kept in his cabin (pp. 16, 18, 19). There is also a long and excited description of *Noctiluca* (pp. 40–41). In one of the very few personal notes, George records his toothache of October 1772 which 'swelled my gums and cheek prodigiously' (pp. 27–28). Unfortunately, the notebook was set aside at the Cape, so that none of the mammals is mentioned. The Dusky Bay section contains full Latin descriptions which have been crossed out by one or more vertical or diagonal lines, presumably when the information had been transferred to the *Descriptiones animalium*. The contents of the notebook were recently published in the section 'Fragmente' (pp. 93–107) of the fourth volume in the series *Georg Forsters Werke* (Kahn *et alii*, 1972).

One of the few to use this notebook was Dance (1971) in his very thorough paper on the conchology of the Cook voyages. Not only is it a useful document for the supplementary information that it contains; it also shows the extent that George Forster participated in the natural history observations, no doubt encouraged and helped by his father, but with a degree of enthusiasm that lends further authority to his drawings.

The Forster animal drawings in the British Museum (Natural History)

The list given here omits the Forster bird drawings since they were very adequately documented by Lysaght (1959 : 280–310). The remainder are placed in major groups (mammals, reptiles, fishes, invertebrates) and thereafter are arranged alphabetically by the original (or principal) name on the drawing; the latter is usually that given also in the *Descriptiones animalium*, but where they differ a cross-reference is given, as also for alternative names on the drawing or in Catalogue B. Scientific names have been italicized, but spelling and punctuation have been retained.

The name is here preceded by the folio number of the drawing. All annotations on the drawing are included, with an oblique to separate items apparently written at different times, or in different hands, or on different parts of the paper. Unless stated otherwise, the annotations are in pencil. Similarly, at least some colour has been applied to the drawing unless stated '*uncoloured*' (i.e. pencil sketch).

The second element in the description begins 'DA' and gives the page number and name in the *Descriptiones animalium*, as well as any other relevant data, such as date or locality if these are not on the drawing; if an exact date is not possible, then a range of dates is given from the itinerary of the voyage (see Lysaght, 1959 : 362–365). Forster's attribution 'Fig. pict. G.' is omitted, but reference is made to 'Fig. pict. F.', 'Fig. pict. Hodges' and to other variants.

The third element begins 'Cat. B' and contains any information from Catalogue B that is not already on the drawing; species names have again been italicized, but spelling and punctuation retained.

The fourth element begins 'Obs.' and gives the page number, date and locality in George Forster's *Observationes* wherever his notes can be correlated with one of the drawings.

A final element refers to the Gotha gouaches, reproductions, etc.

The fate of the specimens brought back from the Cook voyages is extremely complex (Whitehead, 1969). Very many have disappeared without trace, while for those that can be located there is often an element of doubt whether they are indeed the specimens described or merely duplicates. For this reason, no attempt is made here to indicate virtual or even actual iconotypes.

Mammals

17. *Antelope Tragulus* α. *Melanotes* / *redunca* S.N. XIII : 184 ? / Greis-bock in Dutch (and on verso a note of ? locality).
DA p. 36, *Antelope tragulus* F, Fig. picta F, 30 October–22 November 1772; also DA p. 374 (second visit to Cape), 23 March–27 April 1775.
Cat. B: Obs The other Variety the [word missing] or the common *Antelope Tragulus rupestris* of Forster, has brown ears and no white hairs intermixed; of which a Figure Pict. under the name of *Capra rupestris* – by the Dutch called Stein Bock – from generally living on high Hills, & Mountains. Obs. The *Melanota* lives on the plains.

Antelope dorcas (see *Antilope pygarga*)

Antelope oryx (see *Antilope oreas*)

Antelope pygargus (see *Antilope pygarga*)

Antilope dorcas (see *Antilope pygarga*)

Antilope gnu (see *Bos connochaetes*)

30. *Antilope oreas* S.N. XIII : 190 / *Antilope Orix*.
DA pp. 33, 379, *Antelope oryx* F (no drawing indicated; ? first or second visit to Cape).
Cat. B: Elandt. The figured animal was lean & the Belly too strait.

29. *Antilope Oreotragus* S.N. XIII : 189. n. 26. / Klip Springer (and on verso) . . . from a dead animal
DA p. 382, *Antelope oreotragus* F, 23 March–27 April 1775.
Cat. B: Fig. fr a wild dead Animal.

18a. *Antilope Pygarga* S.N. XIII : 187 / *Antelope dorcas* (and on verso) . . . of Good Hope Tame.
DA p. 34, *Antelope pygargus* Pall., Fig. picta F, 30 October–22 November 1772.
Cat. B: Gregarious 2 Dr. from the Menagerie.

18b. *Antilope Pygarga* S.N. XIII : 187 / *antilope Dorcas*.
DA (as above).

19a. *Bos Connochaetes*. Mas. / *Antilope Gnu* S.N. XIII : 189.n.25 / from a drawing in the possession of the Governor / at the Cape (and in ink) Copiā (*uncoloured*).
DA p. 392, *Bos connochaetes* F; possibly also DA p. 40, *Bos poephagus* F, 23 March–27 April 1775.
Cat. B: 2 Copies. The other originals.

20. *Bos Connochaetes* femina.
DA (as above).

21. (no caption; incomplete ink drawing over pencil; a copy of the previous one or taken from the next ?)

22. (no caption; *uncoloured*, perhaps basis for previous one?)

23. (no caption; *uncoloured*, same animal recumbent?)

24. (no caption; *uncoloured*, same, unfinished)

25. (no caption; *uncoloured*, same, whole animal, hind quarters, head)

26. (no caption; *uncoloured*, same, hind leg)

27. (no caption; *uncoloured*, same, head)

28. (no caption; *uncoloured*, same, head)

19. (no caption; no attribution by Dryander bottom left; ? the same animal as 19a)

Bos poephagus (see *Bos connochaetes*)

Capra rupestris (see *Antelope tragulus*)

15. *Cervus Camelopardalis*, Linn. / *Camelopardalis Giraffe* S.N. XIII : 181 / Hanc figuram factam ad amusium picturae / apud Generos. Baron de Plettenberg, Gub. Capensis / emendavi in respectu capitis ex Capite explicato (*uncoloured*).
DA (not included).
Cat B: The small figure copied from an oil painting. The large [i.e. the next one] from Nature.

16. *Cervus camelopardalis* (written twice; *uncoloured*, head only).
DA (not included).

14. *Cervus porcinus* S.N. XIII : 179 / Hog Deer Tomah (*uncoloured*, head only).
DA (not included).
Cat. B: Female without horns. Menagerie at the Cape – supposed from India. The head of Natural Size.

31. *Delphinus Delphis.* ⊙ Octob. 9th. 1774.
DA p. 280, as *Delphinus delphis* Linn.
Cat. B: off Norfolk Isl^{d} South Seas Female Bottle Nose.

Dipus cafer (see *Yerbua capensis*)

Equus zebra (no drawing).
DA p. 40, as *Equus zebra* (no drawing indicated).
Cat. B: *Equus Zebra* α Var. C. b. Sp. copied [i.e. Cape of Good Hope].

5. *Felis capensis* S.N. XIII : 81 (and on verso) Cape of Good Hope.
DA p. 362, as *Felis capensis* Penn., 4 April 1775.
Cat. B: Colour a little too bright or yellow. Obs. 2 Drawings Natural size.

6. *Felis capensis* S.N. XIII : 81 (*uncoloured*, whole animal and one foot).
DA (as above).

10. *Fossor capensis* Forst. / *Mus maritimus* S.N. XIII : 140.n.40 / *Spalax mordens* Linn. fil.
DA p. 32, as *Fossor capensis* F, 30 October–22 November 1772.
Cat. B: C. b. Spei. 3 Drawings Natural Size Burrows in Sand-plaines.

Fossor leucops (see *Talpa leucops*)

Jerbua capensis (see *Yerbua capensis*)

Mus capensis (see *Talpa leucops*)

Mus dentex (see *Talpa leucops*)

Mus maritimus (see *Fossor* and *Talpa capensis*)

7. *Mustela galina* S.N. XIII : 95 / *Viverra amphibia* / Le Vansire (and on verso) Madagascar in the Cape Managerie.
DA (not included).
Cat. B: Madagascar – seen in the Menagerie at the Cape Le Vansire ? Buffon. Lives also in fresh Water. Fig. Natural Size.

2. *PHOCA antarctica* / *ursina – potius volans* (and on the verso) Dusky Bay / young animal / 8 to 10 feet in length.
DA p. 64, as *Phoca ursina* L, 31 March 1773.
Cat. B: Figure taken from a young animal. Gregarious. The largest in N. Zel^{d} 6 feet. The same species in Sth Georgia & Staten Island 10 feet long.

4. *Phoca jubata* / Staten Land ☽ 2 Jan^{y} 1775 (*uncoloured*).
DA p. 137, as *Phoca iubata* F.
Cat. B: New Year Isl^{d} near Statenland Gregarious.

3. *Phoco leonina* Linn. Jany 17th 1775 (*uncoloured*).
DA p. 313, as *Phoca leonina* (name only).
Cat. B: South Georgia only 2 individuals seen.

Phoca ursina (see *Phoca antarctica*)

Spalax capensis (see *Talpa leucops*)

Spalax mordens (see *Talpa capensis*)

Talpa asiatica (see *Talpa versicolor*)

11. *Talpa capensis* Forst. / *Mus maritimus* S.N. XIII : 140.n.40 / *Spalax mordens* Linn. fil. / . . . Comment Petrop Jorn. XIV p. 409 Tab. IX p conf. (and on verso) Cape of Good Hope.
DA p. 32, as *Fossor capensis* F, 30 October–22 November 1772.
Cat. B: [see comment under *Fossor capensis*].

12. *Talpa capensis* Forst. / *Mus maritimus* S.N. XIII : 140.n.40 / *Spalax mordens* Linn. fil. (*uncoloured*, sketches of head and feet).
DA (as above).

9. *Talpa leucops* / *Mus capensis* S.N. XIII : 140.n.39 / *Mus dentax* / *Spalax capensis* Lin. fil. (and on verso) Cape of Good hope.
DA p. 364, as *Fossor leucops* F, 2 March–27 April 1775.
Cat. B: C. B. Spei Natural Size Lives in the same manner [as *Fossor capensis*] common near the Cape.

8. *Talpa versicolor* / —— *asiatica* S.N. XIII : 111.
DA p. 30, as *Talpa asiatica* Lin., 30 October–22 November 1772.

1. *Vespertilio tuberculatus.*
DA p. 62, as *Vespertilio tuberculatus* F, New Zealand Bat, 22 May 1773.

Viverra amphibia (see *Mustela galina*)

13. *Yerbua capensis* (and in ink) *Yerbua capensis* J. R. Forster in Wet. Acad. Handl. 1778. pag. 108. tab. 3 (and again in pencil) *Dipus cafer* S.N. XIII : 159 (drawing lightly squared up in pencil, perhaps by the artist who copied it for the gouache now in Gotha).
DA pp. 365, 368, as *Yerbua capensis* F, 23 March–27 April 1775.
Cat. B: C. B. Spei near Stellen bosch. Larger figure very little less than nature. 2 Drawings. Burrows in the ground.
Note: the gouache copy on parchment is No. 2 in the Gotha series (see below, p. 46). The second of the two drawings mentioned was presumably that used in the description of the species by J. R. Forster (1778).

Birds

(see list given by Lysaght, 1959 : 280–310)

Reptiles

Anguis laticauda (see *Coluber laticaudatus*)

171. *Anguis platura.* Linn / Toona Tore / Taheite May 10th 1774.
DA p. 229, as *Anguis platura.*
Cat. B: . . . Nat. Size.

170. *Coluber laticaudatus* ♂ / Eboohee a-a-oorou / Off Traitor's head in Eromanga ☿. Aug. 3. 1774 / 232 Scuta 2 Squ ante . . . 31 Squa . . . pone a . . . [several words illegible].
DA p. 156, also 256–257, as *Anguis laticauda.*
Cat. B: *Coluber laticaudatus* Linn. Oceanus pacif. prop. Insulam Eromanga. Nat. Size.

169. *Testudo imbricata* Linn. / Namoko I.
DA p. 247, as *Testudo imbricata* (name only).
Cat. B: Dr. from a small specimen.

Fishes

236. *Atherina lacunosa* / Brit. mus. / Caledonia. ♀. 9th Sept. 1774 (*uncoloured*, with sketch of head in ventral view).
DA p. 298, as *Atherina lacunosa* F.
Cat. B: Lacuna on top of the . . . [? nose] Silvery Nat Size.

246. *Balistes fimbriatus* / oiri / *Balistes vidua* mss. aȇleé Tua / Otaheitee.
DA (not included).

247. *Balistes scaber* / båddeek / Queen Charlotte Sound / New Zealand (*uncoloured*).
DA p. 152, as *Balistes scaber* F, 2–25 November 1773.
Cat. B: Nat Size.

Balistes vidua (see *Balistes fimbriatus*).

187. *Blennius capensis* / *Blenn. Superciliosus.* L. / Cape of Good Hope / Schn 175.
DA p. 408, as *Blennius capensis* F, 22 March–27 April 1775.
Cat. B: good Eating.

Blennius cornutus (see *Blennius truncatus*)

186. *BLENNIUS fenestratus* (ink, then in pencil) he Tàrova / Dusky Bay / Schn 173.
DA p. 124, as *Blennius fenestratus*, 3 May 1773.
Note: the gouache copy on parchment, formerly in the Gotha series (see below, p. 46), was on sale in London in 1976 and was reproduced in the catalogue by Joppien (1976 : pl. B).

183. *Blennius gobioides* / running fish / Tanna ☿ 17th Aug^{t}. 1774 : / Schn. 176 (*uncoloured*, three sketches).
DA p. 283, as *Blennius gobioides* F, Fig. pict. F. et G.
Cat. B: Skips and runs fast. Ob. 6 Natural Size Greyish.
Note: in his *Journal* for 18 August 1774, J. R. Forster wrote 'I drew & described this minute nimble animal'.

184. *BLENNIUS* (ink; then in pencil) *littoreus* / *Labrus gobioides* MSS ? (then in ink) S.C.Q.C.S.N.Z. ☽ Oct. 24th. 1774 (then in pencil) Kògop / Schn 177.
DA p. 127. as *Blennius littoreus* F, 7 April 1773; the dates are anomalous, but no other drawing exists.
Note: reproduced in colour by Whitehead (1969b : pl. 30A).

Blennius superciliosus (see *Blennius capensis*)

182. *Blennius truncatus.* / *cornutus* ? L. / o-hoò-o / Huahine. May 18th ☿ 1774 / Schn. 172.
DA p. 231, as *Blennius truncatus* F.

185. *BLENNIUS varius* (ink, then in pencil) he kògop / Charlotte's Sound / Nov 9th / Schn 178
DA p. 127, as *Blennius varius* F, 4 June 1773; the dates are anomalous, but no other drawing exists.

175. (lower) *CALLIONYMUS acanthorhynchos.* / Q. Charlotte Sound New Zealand. Kogohooee / Schn 41.
DA p. 117, as *Callionymus acanthorhynchus* F, 13 April 1773.
Cat. B: Nat Size.
Note: reproduced in colour by Whitehead (1969b : pl. 29).

175. (upper) *Callionymus Trigloides* / Terra del Fuego. 1774. ⊙ 25th December / Schn 44 (*uncoloured*).
DA p. 358, as *Callionymus trigloides* F.

Callyodon coregonoides (see *Sparus pullus*)

Chaetodon harpurus (see *Harpurus literatus*)

Chaetodon lineatus (see *Harpurus literatus*)

Chaetodon meleagris (see *Harpurus inermis*)

Chaetodon nigricans (see *Harpurus nigricans*)

197. *Chaetodon.* / *Speciosus* mss British mus. / *Ch. vagabundus* / Pārūhārāhā / Otaheite.
DA p. 155, as *Chaetodon vagabundus* (name only).
Cat. B: cfr Fig MS – and probably in Linn.

Chaetodon stellatus (see *Harpurus guttatus*)

Chaetodon vagabundus (see *Chaetodon speciosus*)

Clupea cyprinoides (see *Clupea setipinna*)

243. *Clupea mystacina / setirostris* Brouss. ichthyol. dec. 1 / Tanna ⊙ 14th August. 1774 (*uncoloured*).
DA p. 295, as *Clupea mystacina* F.
Cat. B: Sea fish Nat. Size (and in another ink) *Clupea setirostris* Brouss. Ichthyol. Dec. 1.

242. *Clupea setipinna / cyprinoides* Brouss. ichthyol. dec. 1 / Tanna. ⊙ 14th August. 1774 (*uncoloured*).
DA p. 296, as *Clupea cyprinoides* F.
Cat. B: *Clupea setipinna* Tanna Herring colour Taken by angling in fresh water (and in another ink) *Clupea cyprinoides* Brouss. Ichthyol. Dec. 1 (the name also pencilled in).
Note: reproduced in Whitehead (1969b : pl. 7).

Clupea setirostris (see *Clupea mystacina*]

Clupea sinensis (see *Mugil salmoneus*)

Cobitis gobioides (see *Cobitis pacifica*)

231. *Cobitis pacifica / gobioides* ms otaheite p. 111 / o-òboo / Taheitee (*uncoloured*, lateral, dorsal and ventral view; inset is an earlier drawing, *uncoloured*, the same views, entitled) *Cobites pacifica*.
DA p. 235, as *Cobitis pacifica*, Fig. picta F, 22 April–14 May 1774.
Cat. B: 2 Dr. Nat Size brownish (and in another ink) *Gobioides* MS Otaheite p. 111.
Note: the name *gobioides* is cited from p. 111 in the Tahiti section of the volume of ms descriptions by Solander (BMNH., Zoology Library, 89 o S – Sol. Z 1).

Cobitis pacifica (see also *Coryphaena / Gobius strigatus*)

189. *Coryphaena. / Gobius strigatus* Brouss. Ichthyol / Taheitee / Schn 65 (*uncoloured*, sketches of whole fish and mouth).
DA p. 235, a reference to *Gobius strigatus* under *Cobitis pacifica* F, but the description does not fit this drawing and must apply to No 231, which is labelled *Cobites pacifica*; thus, no description can be found for this drawing.
Cat. B: . . . finely painted Specimen in Br. Museum (and in another ink) *Gobius strigatus* Brouss. Ichthyol.

Coryphaena fimbriata (see *Coryphaena / Gobius strigatus*)

188. *CORYPHAENA Hippurus* (in ink; and in pencil) Atlantick Ocean.
DA pp. 3, 155, as *Coryphaena hippurus* (name only), 7 August 1772.
Obs. p. 22, 5 September 1772 (South Atlantic): Caught a Dolphin *Coryphaena Hippurus* . . . Drew . . . an outline of the Dolphin.

248. *CYCLOPTERUS pinnulatus* / More-ằdoo / S.C.Q.C.S.N.Z. ⊙ 23^{d} Oct 1774 (generic name in ink, rest in pencil; dorsal, lateral and ventral view, the last two *uncoloured*).
DA p. 301, as *Cyclopterus pinnulatus* F.
Cat. B: Nat Size.

172. *Echidna variegata / Muraena variegata / Muraena echidna* S.N. XIII : 1135 / Pipiro / Taheitee.
DA p. 181, as *Echidna variegata*, 17 August–1 September 1773.
Cat. B: Fig. MS. Eatable.

235. *Esox alepidotus* / he-pāra / Dusky Bay.
DA p. 142, as *Esox alepidotus* S; 10 April 1773 in Forster's *Journal*.
Cat. B: Fresh water fish In general not above ½ the size of the drawing also in the Rivulet in Ship Cove Totararine.

234. *Esox argenteus* / Silvery. Fins Blackish, a yellow spot under & at (deleted) in the base of PP & P.A. / *Polynemus* ? / Mòhee / Taheitee (*uncoloured*).
DA p. 196, as *Esox argenteus* F, 17 August–1 September 1773; also, p. 257, Tanna (name only).
Cat. B: Frequently caught in the seine at Tanna.

233. *Esox saurus* / he-eeye / N.Z. Dusky Bay (No 1) March 27th 1773.
DA p. 143, as *Esox saurus*.
Cat. B: Willoughby's name.
Obs. p. 75, 26 March 1773 (Dusky Bay): (Latin description).

Exocoetus evolans (see *Exocoetus volitans*)

240. *Exocoetus volitans / E, evolans* L. / A. 1 / Atlantick (and in ink on verso the finrays are numbered; lateral view with below it an *uncoloured* dorsal view).
DA p. 3, as *Exocoetus volitans*, Fig. pict. A.1.G., 13–19 July 1772; also p. 155, Pacific (name only).

Obs. p. 10, 2–6 August 1772 (Atlantic): Had flying fish (*Exocoetus volitans* Linn) come flying upon deck and drew it.

180. *GADUS Bacchus* / Ehògòa / Q. Charl. Sound / Schn. 53.
DA p. 120, as *Gadus bacchus* S, 18 May–7 June 1773.
Cat. B: Night Walkers, because – caught at night with hook.

181. *Gadus colias*: – New Zeland Coalfish / *Perca* ? *colias* / hera-wārre / Schn. 54.
DA p. 122, as *Gadus colias* S, 27 March 1773.
Cat. B: Coal Fish – good Eating.
Note: the gouache copy on parchment is No. 28 in the Gotha series (see below, p. 46).

178. *Gadus magellanicus* / Terra del Fuego ☿ December 21st 1774 / Schn 10 (*uncoloured*).
DA p. 361, as *Gadus magellanicus* F.
Cat. B: Nat Size.

179. *Gadus rhacinus* / mus. Britannic. / Queen Charlotte's Sound (*uncoloured*).
DA p. 304, as *Gadus rhacinus* F, 29 October 1774.
Cat. B: Dusky blackish.

Gasterosteus glaucus (see *Psetta glauca*)

Gasterosteus rhombeus (see *Psetta rhombea*)

Gobius strigatus (see *Coryphaena* / *Gobius strigatus*)

Harpurus glaucopareius (see *Harpurus nigricans*)

198. *Harpurus guttatus.* / *Chaetodon stellatus* mss. Brit. mus. / Pa-à-a / Col olivaceo fuscus, postice puritis albis, oculor irides aurea, subtus corpus pallidus. / Taheitee / Schn. 215 (*uncoloured*).
DA p. 218, as *Harpurus guttatus* F, about 15 March 1774.
Cat. B: Brown with light blue spots.

199. *Harpurus inermis.* / *Chaetodon meleagris* mss. Brit. Mus. / Anamocka. / Schn 210.
DA p. 286, as *Harpurus inermis* F, 28 June 1774.
Cat. B: . . . anomalous.

195. *Harpurus lituratus.* Hasselqu. / *Chaetodon Harpurus* MSS. British museum / Eoòma tarei / Otaheite / Otaheite Epārāhā̀ *Chaetodon* / Schn. 216 (and on verso) vide Nieuhoff voy^{e} in Churchill.
DA p. 218, as *Harpurus lituratus*, about 15 March 1774.
Cat. B: Hasselquist described this fish and of Linnaeus wrongly quoted *Ch. nigricans*.

194. *Harpurus monoceros* / *unicornis* Brouss / *Chaetodon Cornutus* MSS. British mus / Eooma oótoo / P.D. yellowish brown P.C. outer edge pale or greyish Scales as in the other species of this new genus / Oteheite / Schn. 181.
DA p. 219, as *Harpurus monoceros* F, 10 May 1774 *fide* Forster's *Journal*.
Cat. B: Nov. Genus a Linneo sub Chaetodontidi genere (and in another ink) *Balistoides Rhinoceros* MS. *Chaetodon unicornis* Broussonet.

196. *Harpurus nigricans* Linn (last two words deleted) / *glaucopareius* mss / *umbra* MSS / Parai / Otaheite / Schn. 212.
DA p. 214, as *Harpurus nigricans* F, Fig. pict. F. et G., 15 March 1774.
Cat. B: *Chaet. nigricans* Linn.

Harpurus unicornis (see *Harpurus monoceros*)

Labrus gobioides (see *Blennius littoreus* and *B. gobioides*)

239. *Mugil albula* ? / Dusky Bay (*uncoloured*).
DA p. 145, as *Mugil albula* F; 21 April 1773 in Forster's *Journal*.
Cat. B: not Linnei.
Obs. pp. 85–87, 12 April 1773 (Dusky Bay): (Latin description).

238. *MUGIL cirrostomus* / Taheitee / Schn 121 (*uncoloured*, sketch of head from front).
DA p. 198, as *Mugil cirrhostomus* F, 17 August–1 September 1773; also, p. 257, Tanna (name only).
Cat. B: also seen at Tanna (forte idem cum *M. albula* α.).

237. *Mugil salmoneus* / *Clupea Sinensis* L. ? / Tanna. ♃ 18th Aug^{t} 1774 / Schn. 121. / Licht 299 (*uncoloured*).
DA p. 299, as *Mugil salmoneus* F.

Cat. B: whitish.
Note: reproduced in Whitehead (1969b : pl. 8).

173. *Muraena caeca* Linn. ? (repeated) / Para-owtēe-Taheitee / Schn. 536 (whole animal and two *uncoloured* sketches of head in ventral and lateral view).
DA p. 230, as *Muraena coeca* ? Linn., 22 April–14 May 1774; also p. 247 (name only).

Muraena echidna (see *Echidna variegata*)

Muraena variegata (see *Echidna variegata*)

Myxine glutinosa (see *Petromyzon cirrhatus*)

174. *OPHIDIUM Blacodes.* Licht. Forst. p. 115 / Ehokh / New Zealand / Schn 484.
DA p. 115, as *Ophidium blacodes*, 13 April 1773.
Obs. pp. 92–95, 13 April 1773 (Dusky Bay): (Latin description).

219. *Perca boops* / St Helena / Bull-Eye / E-òo – Omai / Mus. Brit. / Licht 411 (*uncoloured*).
DA p. 411, as *Perca boops* F, 16–21 May 1775.
Cat. B: Reddish Omai said to be the same with Eōo otaheitensis.

Perca colias (see *Gadus colias*)

Perca escarlatine (see *Perca urodeta*)

213. *PERCA fulva* ms. / British mus. (*uncoloured*).
DA p. 193, as *Perca fulva*, Tahiti; 17 August 1773 in Forster's *Journal.*
Cat. B: Forgot the place.

191. (verso) *Perca grunniens* / Tanna Aug 13 1774 (*uncoloured*).
DA p. 294, as *Perca grunniens* F, Fig. pict. F.
Note: this is drawn on the back of *Zeus argentarius.*

214. *Perca grunniens* / see the original of this on the back of the drawing of *Zeus argentarius* / Tanna (*uncoloured*) (see previous picture, from which this was neatly copied).
DA p. 294, as *Perca grunniens.*
Cat. B: Obs. Fig copied from a drawing on the back of *Zeus argentarius.*

216. *Perca maculata* (deleted) *variolosa* ms. / EHèoa E Heeròa Eròee / Marquesas.
DA p. 220, as *Perca maculata* F, 7–11 April 1774.

215. *Perca – polyzonias* / mss Brouss. British mus. / *vittata* Mss / Tāā̀pe / Marquesas / Licht Forst 225.
DA p. 225, as *Perca polyzonias* S, 7–11 April 1774.
Cat. B: Fig. MS.

218. *Perca prognathus* / *Sciaena gadoides* / Pato-tēra / S.C.Q.C.S.N.Z. ♂ Oct. 25. 1774 / Schn 301 (*uncoloured*).
DA p. 309, as *Perca prognathus* F, 15 October 1774.
Cat. B: . . . because long under Jaw.

217. *Perca urodeta* / *escarlatina* ms / Terāo- Mātāpòo / Hoa / Marquesas.
DA p. 221, as *Perca urodeta* F, 7–11 April 1774.
Cat. B: . . . from the lines marked on the tail . . . Fig MS.

Perca variolosa (see *Perca maculata*)

251. *PETROMYZON cirrhatus* / *Myxine glutinosa* ni faller JB. / he Toòna / New Zealand Charlottes Sound / Dusky bay / Schn. p 530 (whole fish with half-coloured ventral view of head).
DA p. 112, as *Petromyzon cirrhatus* F, 8 April 1773.
Cat. B: Obs. Mr Sparman says he has seen the same fish in False Bay near the C. b. Spei.

Pleuronectes meneus (see *Pleuronectes pictus*)

192. *Pleuronectes pictus* / *meneus* / mss. British mus. / Bodé / Anamoka June 29th ☿ 1774 / Schn 161.
DA p. 285, as *Pleuronectes pictus* F, 28 June 1774.

193. *Pleuronectes Scapha* / Mohòa / Charlotte's Sound. / Schn 163.
DA p. 130, as *Pleuronectes scapha* S, 30 March 1773.

Polynemus quinquarius (see *Trigla asiatica*)

229. *PSETTA Glauca* (in ink, then in pencil) *Scomber glaucus.* Linn. β. / A 4 / St Jago (*uncoloured*).
DA p. 5, as *Gasterosteus glaucus*, Fig. picta A.4.F, 10–14 August 1772.
Obs. p. 15, 15–16 August 1772 (St Jago): (name only).

Note: another and better drawing made on the return visit in May 1775 – see under *Scomber glaucus*, No 225; also under *Scomber maculatus*, No 228 (Tahiti).

220. *PSETTA rhombea* (in ink, then in pencil) *Gasterosteus rhombeus* / A 5 / St Jago / Licht Forst. 7, 257 / Schn. 33 *S. glaucus* (*uncoloured*).

DA p. 7, as *Gasterosteus rhombeus*, Fig. picta A.5.G., 10–14 August 1772; also, p. 257, Tanna (name only).

Cat. B: *Gasterosteus Rhombeus* St Jago *phps* a new genus silver colour all over also at Tanna, Ascension &c.

Obs. p. 15, 15–16 August 1772 (S^t Jago): (name only).

250. *Raja edentula* / Dark Red colour (meaning pelvic fin) / Light (meaning right pectoral fin) / Whai / Tahaiti. May 10th 1774.

DA p. 227, as *Raja edentula* F; also, p. 256, Tanna (name only).

Cat. B: Nat. Size.

232. *Salmo myops* / MB 14. P.D.12. P.V.18. PP.12. P.C.22./Erai JB. / ground spearing. St Helena. (*uncoloured*).

DA p. 412, as *Salmo myops* F, 16–21 May 1775.

Cat. B: called *Salmo* ob pinnam as posam – distinctum forte genus quod a . . . *Dentex* vocatum.

203. *Sciaena argyrea* / Tanna ♂ 16th Aug^t. 1774 / Schn. 344 (*uncoloured*).

DA p. 291, as *Sciaena argyrea* F, 15 August 1774.

Cat. B: Natural Size.

208. *Sciaena aurata* / *Sparus pagrus* Linn. / Sc. lata . . . / ghoo-pā̀rree / N.Z.Q.C.S. Oct. 18th ♂ 1774 (*uncoloured*).

DA p. 307, as *Sciaena aurata* F.

Cat. B: Obs. The fish that poisoned the Resolution's people at Malacolo was very like this, but somewhat narrower & of a darker red, bordering on purple.

Note: in his *Journal* for 23 July 1774, J. R. Forster recorded the poisonous fish as '*Sparus erythrinus* or *Pagrus*', but seems not to have described it apart from its toxic effects (given under *Sparis* in DA p. 249).

205. *Sciaena ciliaris* / *salmonea* MS / Moghee / Dusky Bay.

DA p. 137, as *Sciaena ciliaris* S, 26 March–11 May 1773.

Cat. B: 2 Dr. The little drawing a little too blue. The larger drawing (i.e. No 209 below) natural large size.

209. *Sciaena ciliaris* / *salmonea* ms ? / S.C.Q.C.S.N.Z. ♂ 25. Octo. 1774 (*uncoloured*).

DA p. 137 (see above).

212. *Sciaena cultrata* / *Scomber clupeoides* ms / British mus / Norfolk Island ♂ 11th Oct. 1774 / Schn. 343 Licht. 292 (*uncoloured*).

DA p. 292, as *Sciaena cultrata* F, 10 October 1774.

Cat. B: whitish.

Sciaena gadoides (see *Perca prognathus*)

204. *Sciaena lineata* / Dusky Bay / Schn. 342 (part coloured with grey and yellow washes).

DA p. 134, as *Sciaena lineata* S; 27 March 1773 in Forster's *Journal.*

207. *Sciaena macroptera.* / living subject / *Sparus carponemus* Brit. mus. / Queen Charlotte's Sound / Schn. 342 (an outline of fish on verso).

DA p. 136 (as below).

206. *Sciaena macropteras* / *Sparus carponemus* Mus. Brit. / a dead subject / Taraghee / NZ (No 2) Dusky Bay March 27th 1773.

DA p. 136, as *Sciaena macroptera* F.

Cat. B: 2 drawings. a. fr a dead fish Dusky Bay b. fr a live – Head better Charlotte Sound (i.e. the previous drawing).

Sciaena mulloides (see *Sciaena trutta*)

Sciaena salmonea (see *Sciaena ciliaris*)

Sciaena sapidissima (see *Sciaena trutta*)

210. *Sciaena trutta* / *sapidissima* / *Sciaena mulloides* / S.C.Q.C.S.N.Z. ☽ 7. N. 1774 (*uncoloured*).

DA p. 147, as *Sciaena trutta* S, 18 May–7 June 1773; also, p. 279, October 1774 (name only).

Cat. B: 2 Dr Grows to a large size.

211. *Sciaena trutta* / *Sciaena mulloides* ms. / inches 8½ long 2. broad 1⅞ head (*uncoloured*).
DA p. 147 (see above).

226. *Scomber adscensionis.* Osbeck. / I. Ascension : May 28th ⊙. 1775 / Cavalle at St Helena / Licht. 412 (*uncoloured*).
DA p. 412, as *Scomber ascensionis* F.
Cat. B: *ascensionis* Osbeck – wrongly quoted by Linn. for *Scomber glaucus.*

224. *Scomber capensis*, Elft: / *Scomber saltatrix* / Cape of Good Hope (*uncoloured*).
DA p. 413 (name in index, but absent from text).
Cat. B: *capensis* C b Sp white.

Scomber clupeoides (see *Sciaena cultrata*)

222. *Scomber dentex.* / *Scomber lanceolatus* ms / Màga / Q. Charlotte's Sound. / Licht 141 (*uncoloured*).
DA p. 141, as *Scomber dentex* S, 18th May–7 June 1773.
Cat. B: Pin maker Nantes because the dorsal spines very sharp 3 feet long Bony fish.

Scomber dimidiatus (see *Scomber trachurus*)

225. *Scomber glaucus* Linn. / I. Ascension 28th May. ⊙ 1775 (*uncoloured*).
DA p. 5 (refers only to *Gasterosteus glaucus* of the previous visit to Ascension Island, in August 1772 – see under *Pseta glauca*, No 229; see also *Scomber maculatus*, No 228).
Cat. B : α. best Ascension.
β. St Jago (i.e. *Psetta glauca*, No 229) Silvery colour Linn.

227. *Scomber helvolus* / I. Ascension. May 29th. 1775. / Schn 35 (*uncoloured*).
DA p. 415, as *Scomber helvolus* F.

221. *Scomber hippos* Linn ? Brit. mus. / Āhèe / Otaheite / New Zealand ? (*uncoloured*).
DA p. 199, as *Scomber hippos* Linn. F, 17 August–1 September 1773; also, p. 155 (name only) and p. 413 (diagnosis, comparisons).
Cat. B: *Hippos* ? Linn. Otaheite.

Scomber lanceolatus (see *Scomber dentex*)

228. *Scomber maculatus* / *glaucus* L. (*uncoloured*).
DA p. 195, as *Scomber maculatus*, Tahiti and environs, 17 August–1 September 1773.
Note: see also under *Psetta glauca* No 229 and *Scomber glaucus* No 225, both from the Atlantic.

Scomber micans (see *Scomber trachurus*)

230. *Scomber Pelamys* / Peeràru / A 2. / Atlantick (the finrays numbered in ink on the verso).
DA p. 3, as *Scomber pelamys*; 12 August 1772 in Forster's *Journal.*
Obs. p. 10, 13 August 1772 (Atlantic): Struck a Bonito (*Scomber Pelamys* Linn) and drew an outline of it. Also, p. 22, 3 September 1772: Caught a Bonito . . . finished my drawing of the Bonito.

Scomber saltatrix (see *Scomber capensis*)

223. *Scomber trachurus* Varietas / *Dimidiatus* ms Brit. mus. / Brouss. / *micans* ms / Horsemackerel or Scad. – / nat size / Dusky Bay (*uncoloured*).
DA p. 155, as *Scomber trachurus* (name only); also, p. 257 (Tanna, name only) and p. 413 (diagnosis, comparisons).
Cat. B: var. Linn. . . . N. Zei Dusky Bay.

190. *Scorpaena* / *SCORPAENA Cottoides* / *Cardinalis* MS / Enohùtara / NZ / No 8 Dusky Bay April 1 1773 / Schn 196.
DA p. 128, as *Scorpaena cottoides* F, 30 March 1773.

Scorpaena cardinalis (see *Scorpaena cottoides*)

Sparis (see *Sciaena aurata*)

200. *Sparus* – / *miniatus* / *Sparus miniatus* Licht. Forst. p. 289 / Ehuróa / Namoka.
DA p. 289, as *Sparus miniatus* F, 27 June 1774.

Sparus carponemus (see *Sciaena macroptera*)

Sparus erythrinus (see *Sciaena aurata*)

201. *Sparus ornatus* / The green Dark, bluish – purple dirty or greenish cast. the blue spots & lines to strike out better. upper edge of dorsal fin of the same color as that of anal. / Pa-ow-òura (or perhaps Pa-ovo-òora).

DA (no species of this name under *Sparus*, *Labrus*, etc.).

Sparus pagrus (see *Sciaena aurata*)

202. *Sparus pullus* / an *Callyodon Coregonoides* mss / Q Charlotte's Sound (*uncoloured*).
DA p. 306, as *Sparus pullus* F, 28 October 1774.
Cat. B: Blackish Sooty – *pullus*.

249. *Squalus striatus.* / *vittatus* ms. Specim. in mus. Britanic. / Cape of Good Hope (*uncoloured*, whole fish and sketches of head in dorsal and ventral views).
DA p. 407, as *Squalus striatus* F, 23 March–27 April 1775.

Squalus vittatus (see *Squalus striatus*)

245. *Tetrodon hispidus.* Linn. / Hoóe-hooé Kills men / Raietea. June 3^{d} 1774.
DA p. 247, as *Tetrodon hispidus* (name only).
Cat. B: The Inhabitants say he is poisonous and kills Men.

244. *Tetrodon scleratus* / *Lagocephalus* ? / 18 PP. 12 P.D. 6.C. 10.A / Poemanghee. 1774. ☿. Sept. 7th / N. Caledonia / Schn 506 (*uncoloured*).
DA p. 282, as *Tetrodon scleratus* F; also pp. 254, 255, 257.
Cat. B: Poisonous. The effect lasted about 3 days – In a few hours a singular symptom took place viz not being able to distinguish at all of weights – e.g. between a feather & a quart pot.
Note: the toxic effects of this pufferfish were more fully described by J. R. Forster in his *Journal* for 8 September 1774, as also in DA p. 254.
The gouache copy on parchment is No 27 in the Gotha series (see below, p. 46).

241. *Trigla asiatica* Linn. / *Polynemus quinquarius* Linn. / Òmā / Otaheite (*uncoloured*, a fair copy of an original sketch pasted below, entitled) *Trigla Asiatica* / *Polynemus quinarius* / Otaheite (*uncoloured*).
DA p. 236, as *Trigla asiatica* Lin., Fig. picta F, 22 April–14 May 1774; also, p. 247, Raiatea, 25 May–4 June 1774 (name only); also 20 August 1774 in Forster's *Journal.*
Cat. B: 2 Drawings *Polynemus quinquarius* Linn Probably twice described by Linn.

176. *URANOSCOPUS maculatus* Vid descript. in MSS from new Zealand 1st voyage / New Zeeland / Badée / Schn 49 (*uncoloured*, light brown crayon and pencil).
DA p. 118, as *Uranoscopus maculatus* F, 13 April 1773.
Cat. B: 2 Drawings.
Note: reproduced in Whitehead (1969b : pl. 28).

177. *Uranoscopus maculatus* / Q Charl Sound (*uncoloured*, light brown crayon and pencil).
DA p. 118 (see above).

191. (recto) *Zeus argentarius* / Tanna Aug 13 1774 / Schn 96 (*uncoloured*).
DA p. 288, as *Zeus argentarius* F, Fig. pict. F.
Cat. B: on the same paper is *Perca grunniens* – Fine Silver.
Note: on the reverse is the original sketch for *Perca grunniens* No 191 verso.

Invertebrates

252. *CANCER* / Otaheite (*uncoloured*, enlarged but with life-size sketch above, also *uncoloured*).
DA p. 155 ? (i.e. *Cancer squilla*, name only); 30 August 1773 in Forster's *Journal.*
Cat. B: In the Rivers 4 little bigger than the small figure.

258a. *Clio conchacea* / Atlantick (*uncoloured*, four views).
DA p. 29, as *Clio conchacea* F, 12 October 1772.
Obs. p. 30, 12 October 1772 (South Atlantic): Caught several specimens of a new *Clio* (*Clio conchacea*).

261a. *CNIDE hyalina* (ink, and in pencil) Atlantick.
DA p. 12, as *Cnide hyalina*, 15 September 1772.
Cat. B: *Dagyra* MS.
Obs. p. 22, 8 September 1772 (South Atlantic): Also caught a new Zoophyte, which we called *Cnide hyalina*.

Dagyra volva (see *Thalia lingulata*)

254. *DORIS laevis* (ink, and in pencil) *Doris l* / Atlantick / Sept. 4th 1772 / GF. (dorsal and ventral views).
DA p. 10, as *Doris laevis*, 5 September 1772.

Cat. B: Nat Size. Fig MS.
Obs. p. 22, 5 September 1772 (South Atlantic): Caught . . . *Doris laevis* . . . Drew the medusa, *Doris* . . .

Doris radiata (see *Glaucus atlanticus*)

254a. *GLAUCUS atlanticus* (ink, and in pencil) *Doris radiata* S.N. XIII. p. 3015.a.13. / Atlantick Ocean; on the Line.
DA p. 11, as *Glaucus atlanticus*, 15 September 1772.
Cat. B: *Mimus volutator* MS. Fig.
Obs. p. 22, 8 September 1772 (South Atlantic): Caught a new genus of Mollusca & called it *Glaucus atlanticus.*

256. *Holothuria Physalis* / Atlantick (*uncoloured*).
DA (not mentioned); 15 September 1772 in Forster's *Journal.*
Obs. p. 24, 15 September 1772 (South Atlantic): Caught the Portuguese Man of War, *Holothuria Physailia* Linn. I drew an outline of it.

257. *Holothuria tentaculata* / tentaculis frondesis, verrucarum ordinibus quinque / Raïetea May. 27. 1774 (*uncoloured*).
DA (not mentioned).
Cat. B: Ularetea Obs. Called Swallow & Berce de la Mer or Beche de Mer in the Moluccae where dried for Chinese markets. Figure in Forskål.

Medusa passiflora (see *Medusa porpita*)

259a. *MEDUSA pelagica.* Linn. (ink, and in pencil) āwe-ā̀we Legs anohòrā̀ Mouth / Atlantick / Sept. 4th 1772 / GF (dorsal and ventral views).
DA (not mentioned).
Obs. p. 22, 5 September 1772 (South Atlantic): Caught . . . several *Medusa pelagica* . . . Drew the medusa.

258b. *Medusa porpita* / Atlantick (three views).
DA p. 13, as *Medusa passiflora*, 27 September 1772.
Obs. p. 25, 27 September 1772 (South Atlantic): Caught . . . another species of *Medusa* which appeared to be new.

259b. *Medusa velella* Linn / Hèma-hèmā / Atlantick.
DA (not mentioned); 15 September 1772 in Forster's *Journal.*
Cat. B: *Phyllodora velella* MS.
Obs. p. 24, 15 September 1772 (South Atlantic): Caught a species of Blubber, by D. Browne called a Sallyman & by Linnaeus, *Medusa Velella.*

260. *Medusa vesia* / Medusa orbicularis disco supra conregulari, limbo integerrima multiradiata, subtus disco concavo, margine villoso. / Poo / off New Zealand (*uncoloured*, dorsal and ventral views).
DA (not mentioned).
Cat. B: did eat it.

Mimus volutator (see *Glaucus atlanticus*)

253. *Monoculus Squali* / Tierra del Espiritu Santo (*uncoloured*).
DA (not mentioned).
Cat. B: among the New Hebrides near Terra des Sp. Sat.
Note: recorded by J. R. Forster in his *Journal* for 26 August 1774.

261b. Phosphorescent Animalicule. / a. natural Size b. magnified with No 4 c. ditto with No 1 / Cape of Good Hope (*uncoloured*, three different sizes).
DA (not mentioned).
Cat. B: see Cooks Voyage, & Forsters Voyage.
Obs. p. 40, 29 October 1772 (off Table Bay): The Sea was illumined around us to a most extraordinary degree [then follows a long description].

Phyllodore velella (see *Medusa velella*)

255. *Thalia lingulata* / *Dagyra volva* ms / In Oceano Atlantico / Febr. 16th 1775 (*uncoloured*, two views).
DA p. 14, as *Thalia lingulata.*
Cat. B: Ocean South fr the Cape b. Sp. high latitude 50° S. *Dagyra* MS.

The Forster animal drawings in Gotha, Weimar and Jena

The following list has been compiled from the information given by Steiner & Baege (1971) and Joppien (1976). The names used here are those given in the *Descriptiones animalium*; for the Gotha series these are here preceded by the numbers used by George Forster in a German list of the drawings (dated 17 June 1780 at Cassel – reproduced by Steiner & Baege); Nos 24, 27, 28 do not occur in this list but are numbered according to another Forster list (in French – also now at Gotha).

F	folio number of original Forster drawing
DA	*Descriptiones animalium*, page number
S & B	Steiner & Baege (1971)
J	Joppien (1976)

A. Forschungsbibliothek, Gotha (gouache on parchment)

1. [Antelope] Not seen; possibly based on F 30
2. [Jerbua] Not seen, but evidently *Yerbua capensis*, on F 13, DA 365
3. **Vultur plancus*, on F 33, DA 321, J pl. A
4. *Psittacus hysginus*, on F 42, DA 159, S & B pl. 1
5. *Cuculus nitens*, on F 57, DA 151, S & B pl. 2
6. *Alcedo cancrophaga*, on F 60, DA 4, S & B pl. 3
7. *Certhia cincinnata*, on F 61, DA 78, S & B pl. 4
8. *Certhia olivacea*, on F 62, DA 79, S & B pl. 5
9. *Sternus carunculatus*, on F 144, DA 81, S & B pl. 6
10. *Muscicapa dibapha*, on F 150, DA 267, S & B pl. 7
11. *Muscicapa ventilabrum*, on F 155, DA 86, S & B pl. 8
12. *Scolopax caffra*, on F 118, DA 49, S & B pl. 9
13. *Rallus caffer*, on F 129, DA 50, S & B pl. 10
14. *Tringa pyrrhetraea*, on F 120, DA 174, S & B pl. 11
15. *Tantalus capensis*, on F 116, DA 48, S & B pl. 12
16. *Tantalus melanops*, on F 117, DA 332, S & B pl. 13
17. *Procellaria antarctica*, on F 95, DA 60, S & B pl. 14
18. *Procellaria nivea*, on F 90, DA 58, S & B pl. 15
19. *Procellaria similis*, on F 86, DA 59, S & B pl. 16
20. *Diomedea albatrus*, on F 99, DA 27, S & B pl. 17
21. *Diomedea chrysostoma*, on F 101, DA 24, S & B pl. 18
22. *Diomedea palpebrata*, on F 102, DA 55, S & B pl. 19
23. *Chionis lactea*, on F 125, DA 330, S & B pl. 20
24. **Blennius fenestratus*, on F 186, DA 124, J pl. B
27. *Tetrodon scleratus*, on F 244, DA 282
28. *Gadus colias*, on F 181, DA 122

* Sold 1936; offered for sale 1976 by Hartnoll & Eyre in London (see Joppien, 1976).

Schlossmuseum, Weimar (watercolour on paper)

KK 449	*Charadrius glaucopus*, on F 123, DA 176, S & B pl. 23
KK 500	*Alcedo cancrophaga*, on F 60, DA 4, cf S & B pl. 3
KK 501	*Muscicapa dibapha*, on F 150, DA 267, cf S & B pl. 7
KK 502	*Cuculus nitens*, on F 57, DA 151, S & B pl. 2
KK 503–4	[European birds]

Universitätsbibliothek, Jena (watercolour on paper)

1. *Aptenodytes antarctica*, on F 82, DA 56, S & B pl. 21
2. *Aptenodytes magellanica*, on F 83, DA 351, S & B pl. 22

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Early mineralogy in Great Britain and Ireland

W. Campbell Smith

Historical series Vol 6 No 3 29 June 1978

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Early mineralogy in Great Britain and Ireland

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Early natural histories and catalogues

Minerals, apart from their use as charms and as materia medica, had attracted little attention among scientifically-minded men in Britain before the last quarter of the seventeenth century. An early work published in Oxford in 1661 was Robert Lovell's *Panzoologico-mineralogia, or a compleat history of animals and minerals containing the summe of all authors both ancient and modern, galenical and chymical, touching earths, metalls, semi-metalls, with their natural and artificial excrements, salts, sulphurs and stones, more pretious and less pretious, etc.* The part dealing with minerals is chiefly devoted to their 'medicinal' uses with the sketchiest indications of where they are to be found. The list, under Lithologia, of 'stones or jewels more pretious' is quite extensive beginning with Achates, Amethyst, Berill, Bezoarstone and ending with Topaz; while the list of 'stones less pretious' runs from Alabaster to Unicorne-stone and Whetstone, and includes Load-stone of which Lovell's account is quoted by Miss Jessie M. Sweet (1935) in her description of Sir Hans Sloane's *Materia Medica.*

Another of the early works which were brought to my attention by Dr Roy Porter is Christopher Merret's *Pinax rerum naturalium Britannicorum continens vegetabilia, animalia, et fossilia in hac Insula reperta inchoatus*; published in London in 1666, with another edition in 1667. Here the author is more concerned with their uses and, to some extent, with localities where some of the 'fossils' are to be found. Thus he records that lead and manganese occur in the Mendip Hills, and under Diaphani, the first entry is 'Adamantes quos vocant Bristoll stones'. Irish slate (Lapis Hibernicae) is listed but its use is described, not as in Lovell, 'often used against bruises etc.', but for 'writing down things to be remembered'.

Another seventeenth century work, John Webster's *Metallographia: or an history of metals, etc.* 1671, treats of metals and their ores and mines with a chapter on 'other stones' including chrysocolla, Magnes, the Load-stone, Blood-stone, Schistum, the Lazul-stone, etc., and a final chapter on the transmutation of metals.

There is some mention of minerals in Robert Plot's *Natural history of Oxford-shire* (1677), and in his later work, *The natural history of Stafford-shire* (1686), both of which are referred to below, but of more particular interest, because of its detailed treatment of minerals, is the catalogue of the minerals (and fossils) in the Royal Society's Collections by Dr Nehemiah Grew

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(1681). This collection was commenced very early in the history of the Royal Society, founded in 1660. Robert Hooke was appointed curator in 1662. His chief duty was to furnish the Society with experiments at their meetings, but he was himself very wishful to have 'as full and complete a collection of all varieties of Natural bodies as could be obtained'. The use of such a collection is 'for the most serious and diligent study of the most able proficient in natural philosophy' (Edwards, 1931 : 56).

The whole collection was transferred to the British Museum in 1781. Some of the fossils are still identifiable but none of the mineral specimens with any certainty. However, Grew's Catalogue shows something of the state of the knowledge of minerals as it was in England nearly three hundred years ago. The catalogue of the 'Minerals' is divided into three Sections: of Stones; of Metals; and of Mineral Principles and each Section is divided into chapters.

In Section I the first three chapters deal with fossils, as now understood, and then follow three more: of Gems; of Regular Stones; and of Irregular Stones.

The first entry under Gems is 'Diamonds' but whether the specimen really contained diamonds seems doubtful. Then come: Crystal, including Amethyst, both pale violet and white are mentioned; The Granate; Topaz, Smaragdus, Agate, Calcedony, Onyx, Sardonyx, Jaspis [a 'geometric jaspis', figured in pl. 20, appears to be chiastolite], the Nephritic Stone, and Turcois. They are briefly described and their medicinal properties are frequently mentioned.

Chapter V, of Regular Stones, deals with a great variety: here are some Stalagmitic Stones, Eagle Stones, Toadstones, Belemnites, a flint arrow head, and also various Spars. A 'Silver Spar' figured in plate 21, is a group of quartz crystals 'composed into the figure of a great bud of the colour of grey crystal'. Talk, and the 'foliated Talk' (figured in pl. 21), are gypsum, but 'a great crystalline Talk-spar' sent by Dr Erasmus Bartholinus is Iceland Spar 'dug out of a very high mountain in Island, one whole side of which consists of this Spar'. Another 'Spar' is 'a rhomb of Muscovy Glass. By most called Selenites, used in Saxony and other places in Germany in Windows'.

Grew also describes several kinds of Septarian nodules, which he names 'Waxen Veins'. One of these is the 'Starred Waxen Vein' that was given by Sir Rob. Moray (a founder member of the Royal Society) 'Found in the Isle of Sheapy'.

The starred waxen vein is a name for the radiating groups of crystals of baryte found on the septa of some of the septarian nodules 'waxen veins', from the Isle of Sheppey. Grew noted that 'This star is of quite different nature from the stone on which it grows, as making no effervescence with acids . . .'.

Another name for these radiating barytes was Astrapia. They were so described by the Rev. Dr John Walker, Jameson's predecessor as professor in Edinburgh. Jameson mentions having seen specimens so labelled in the Leverian Museum on his visit to London in 1793 (Sweet, 1963).

Chapter VI, of Irregular Stones, includes a great variety of minerals not exhibiting any regular form. So here are brought together: Emery; Flint; Serpentine Marble, called Ophites; Lapislazuli, i.e. 'blewstone'; 'Loadstone' from Magnesia 'a country between Thessaly and Macedonia'; Soapstone, Pumis Stone, and a 'cynder' from Etna.

Section II, of Metals, is treated in three 'Chapters': Of Gold, Silver and Copper; Of Tin, Lead and Iron; Of Antimony, Mercury and other Metallic bodies. In this last are found Cinnabar, Marchasite, Mundick, and Pyrites.

Section III, Of Mineral Principles, includes: Chapter I, Of Salts (Sal-ammoniac, Salt, Blue and Green Vitriol); Chapter II, Of Ambers and Sulphurs, under which head are also: Bitumens, and also 'Flake Stone Coal, by some called Black Amber', [Jet], 'found in Misnia, Bohemia'. Lastly, Chapter III, Of Earths, includes various Boles (Lemnian, Armenian, etc.) Volcanic Ash from Vesuvius, presented by J. Evelyn Esq., and 'earth which rained lately upon Teneriff' ['Blood Rain'; see Bannerman, 1922]. This Catalogue, then, gives an indication of the nomenclature and of some of the ideas in vogue with such persons, doctors and others, as had any knowledge of minerals in those days. The names and ideas were derived no doubt in part from Theophrastus, Pliny, Agricola, and Aldrovandi and, of seventeenth-century writers, Boetius de Boodt and John de Laet, to all of whom Grew refers.

At the very end of the seventeenth century there was published Edward Lhuyd's *Lithophylacii*

Britannici Ichnographia ... (1699). It is chiefly of importance to palaeontologists but its first chapter is a catalogue of the mineral specimens in the collection at the Ashmolean Museum, made in part at least by Richard Dyer and labelled by Lhuyd who was Under-Keeper in 1684 and became Head-Keeper in 1690 (Gunther, 1945 : 222).

The entries are in Latin and the catalogue lists various specimens of quartz (*crystallus* and *iris*), including '*Iris vulgaris, Adamas Bristoliensium vulgo dicta*' (pl. I, fig. 15), a doubly terminated crystal of quartz; and a much larger crystal, from Snowdonia; '*Crystallus maxima Britannica*, ... *Invenimus Alpibus Arvoniae juxta lacum Fynnon Vrech*, ...'. There are also listed several varieties of 'Fluor' of which some called *Fluor triquetrus* appear from their figure (pl. I, fig. 34) to be dolomite or calcite. Other specimens are numerous Stalagmites, Selenites, and Talcum (gypsum). The collection contained ninety specimens.

References in the catalogue are made to Aldrovandi, Agricola, Dr Greb [i.e. Grew] and to Plot. The last mentioned reference is to Robert Plot's *Natural history of Oxford-shire* (1677 : 96), referred to above, in which he describes a few minerals encountered in the county. They include: 'Chrystals, Selenites, and Spars' of which some are 'by the Miners called *Cawke* and the Latins, *Fluores*; which (say they) yet retain so much fluid, that with the heat of fire, like *Ice* in the *Sun*, they melt and flow'.

In his later work, *The natural history of Stafford-shire* (1686), Plot wrote at length on the coal and iron-stone of the county. Of crystals he describes Selenites of several kinds of which one (pl. xi, fig. 1) is a cleavage rhomb of calcite 'of a cubico-rhomboidal form, all the pieces being constantly Hexaedra of equal obliquangular sides, or oblique angled Parallelopipeds'. He gives a good description of quartz crystals 'sometimes stained a violaceous colour ... found in digging in Barrow-hill in Pesnet-Chase' (pl. xi, fig. 8); also of a group of scalenohedra of calcite 'from limestone rocks near Dudley'.

In addition to his notes on these minerals in the two county 'natural histories' Plot has two short papers in the *Philosophical Transactions*. One is on the sand in the brine of the salt works in Staffordshire (1683); the other, 'on Black-Lead, found only at Keswick and there called Wadt or Kellow' (Plot, 1699).

Two other county natural histories a little later than Plot's *Stafford-shire* are Charles Leigh's *Natural history of Lancashire, Cheshire, and the Peak in Derbyshire*, published in 1700, and the Reverend Thomas Robinson's *Essay towards a natural history of Westmorland and Cumberland*, published in 1709.

Leigh's work, illustrated with many plates of antiquities and some 'fossils', gives some account of numerous 'Spars of several sorts', Fluor in Derbyshire, Salt Rocks in Cheshire, Iron ores, Lead ores, Copper ores, Vitriol, Pyrites and Potters' Clay, and many others, listed in an extensive index.

Robinson's book gives some account of 'several mineral and surface productions' of the two counties but perhaps its interest is more theological than mineralogical, for to it is annexed 'A Vindication of the Philosophical and Theological paraphrase of the Mosaick system of Creation'.

There were some 'minerals, stones and earths' in the collection of Sir Hans Sloane, commenced probably about 1690, and also 'Pretious stones, agates, jaspers, etc.' and 'Vessels' of the same, probably from the still earlier collection of William Courten (or Charlton) which was bequeathed to Sloane in 1702; this collection contained over 10 000 items listed under Mineralogy in the synopsis prepared after Sloane's death in 1753. Such specimens from Sloane's collection as can be identified in the Department of Mineralogy of the British Museum (Natural History) have been recorded and described by Miss J. M. Sweet (1935), formerly of that Department, with illustrations of several of the bowls and rings in agate, mocha-stone, carnelian and jasper, and two beautiful pieces in jade (nephrite); a two-handled bowl and a carved mirror-frame.

Another collection of about the same period but devoted entirely to 'minerals and extraneous fossils' was started about 1696 by the remarkable Dr John Woodward, Professor of Physic in Gresham College in London. This collection was bequeathed to the University of Cambridge in 1728 together with a sum of money to found a Professorship, now the Woodwardian Professorship of Geology. The collection has been retained in its original arrangement, and with it is kept Woodward's own catalogue.

Most valuable to the study of this collection and its classification is a book, published in two parts in 1728 and 1729, after Woodward's death, which comprised *A catalogue of the English fossils in the collection of John Woodward* and lists also of the foreign minerals and fossils therein. Earlier, 1695, Woodward had produced *An essay toward a natural history of the Earth* and in 1696 a remarkable pamphlet which gave detailed instructions for making scientific observations and for '*Collecting, preserving, and sending over natural things*', in fact instructions for collectors of geological, botanical and zoological material.

Something of the same kind with particular reference to mines and quarries appears in chapters of another book by Woodward published in 1728 entitled *Fossils of all kinds digested into a method.* The 'method' classifies the minerals into 1, Earths; 2, Stones; 3, Salts [Fossil salt; Salammoniac, and tincal (borax)]; 4, Bitumens [liquid naptha, Barbadoes Tar]; 5, Minerals; and 6, Metals. The Earths are subdivided into (i) 'Those found in Strata'; and (ii) 'Those found in smaller masses', which are again subdivided, the first division being 'such as do not exceed marble in hardness'. These are 'Bowlder stones, clay-stones and stony nodules'. Most of the semi-precious stones are referred to this division.

Dr V. A. Eyles in an article on John Woodward remarked that Woodward was the first British author to publish a work solely devoted to the classification of minerals (Eyles, 1965). A more nearly contemporary comment is made by Thomas Pennant who, in a letter to Edward Rawstone in 1753, wrote that he favoured Woodward's System and considered it now 'generally esteemed the most plausible' (Smith, 1913).

Another 'classification' not much noticed, perhaps in consequence of its truly remarkable nomenclature, is that of John Hill, the King's gardener at Kew, who published a general Natural History in three folio volumes (1748–1752), the first of which is devoted to 'The history of fossils'.

Emanuel Mendes da Costa (1717–1791), curator of the Royal Society's Collections, also attempted *A natural history of fossils* but only the preface and the first volume was published owing, da Costa implies, to lack of sufficiently numerous subscribers. The published volume (1757) deals only with Earths and Stones: Marbles, *Marmora profera* (basalts, etc.) and Granites. It is chiefly notable for its description (with a plate) of the Giant's Causeway, quoting observations by Dr Richard Pococke, Bishop of Ossory, and Mrs Susannah Drury.

John Morton, who published *A natural history of Northamptonshire* in 1712, treats of minerals on somewhat similar lines to Woodward; Chapter I dealing with Earths, including the Earths of the Lower Strata; Chapter II with Stones; and, Chapter II, part 2, with 'Stones in lesser masses'. Here are included Pyritae, Sparry Nodules, Belemnites, Bezoar, Aetites (Eagle Stones), Geodes, and Enhydros, and Selenitae. He remarks that 'Selenitae, found at Worthrop [WORTHROP = Wothorpe 1 mile west of Stamford-Baron, Northants] in the lane leading to Stamford are there called 'Worthrop diamonds'. With an eye to possible economic uses for the minerals in the county he opines that Selenitae are composed of the same matter as Talc ['Laminated gypsum' was sometimes called 'Talc'; see p. 4] and 'we may fully make use (in medicine) of the Selenitae our County affords in plenty instead of the Talc of Italy and other foreign countries'. He also suggests that if the silver-coloured 'pyritae, which are generally stored with vitriol particularly of the copperas kind, are found in sufficient plenty a copperas work for making of ink might be set up in the County' (Morton, 1712).

Another county natural history and one which deals mainly with rocks, minerals and mining is *The natural history of Cornwall* by William Borlase, Rector of Ludgvan, published in 1758. Here again are chapters on Earths, Clays, Steatites or Soapstones, and then: Stones of use, Stones of ornament and curiosity, and Stones of profit. Spars and crystals of various kinds are described and there are plates of several. Borlase distinguished between crystals plain (i.e. massive), incrustations, stalactitic forms, etc., and figured crystals (i.e. showing crystal form). Stones of profit are the products of the mines. Here are described: Bismuth, speltre, naptha, antimony, manganese, loadstone, molybdaena, cobalt, and Mundic, . . . a long account of this last. Chapters on metals deal with: tin, iron, copper, silver, lead and quicksilver, and gold, as they occurred in Cornwall. Borlase had made a considerable collection of antiquities, fossils, and minerals, which, during his lifetime, he had given to the (old) Ashmolean Museum. It seems that none of them has survived (Gunther, 1925 : 223).

Eighteenth-century and nineteenth-century mineral collections

Here may be mentioned also several other mineral collections made in the eighteenth century, and the early part of the nineteenth, by various gentlemen in Cornwall, some of whom were adventurers in the Cornish mines, and with them I shall mention also Thomas Pennant, zoologist and author, of Whiteford in Holywell, Flintshire, who, while an undergraduate at Oxford, visited Borlase in Cornwall in 1746 or 1747, and started to make a collection of minerals from that time.

Most of our knowledge of these early collections we owe to Sir Arthur Russell, who in the course of time incorporated parts of the Cornish ones into his own collection which with his manuscript notes he bequeathed to the British Museum (Natural History) (Kingsbury, 1966).

These collections were being made at a time when splendid specimens were obtainable from the higher levels of the mines of Cornwall and Devon. One of the earliest was that of Philip Rashleigh of Menabilly (1729–1811), to which I shall refer again. Others, slightly later, were the collections made by John Hawkins of Trewithen (1761–1841), Edmund Pearce (1788–1856), and the three members of the Fox family of Falmouth: George (1784–1850), Robert Were Fox (1789–1877) and Alfred (1794–1874). Still others were those of John Williams of Scorrier (1753–1841), Sir John St Aubyn (1758–1839), and Joseph Carne of Penzance (1781–1858).

John Williams of Scorrier was principal agent for the North Down and Gwennap mines. Charles Hatchett visited him in 1796 and records in his diary that at that time Scorrier was said by C. S. Gilbert to 'contain the most valuable variety of mineral specimens of any house in Europe' (Raistrick, 1967). The collection was added to by John Williams' son, John Michael (1813–1880) and by his grandson, John Charles of Caerhays Castle (1851–1939), who in 1893 presented 550 selected specimens to the British Museum (Natural History). In 1948 a further selection of 585 specimens was purchased by Sir Arthur Russell.

The St Aubyn Collection, one of the many catalogued by Bournon (see below), was in 1876, according to Sir Arthur Church, in the Town Hall at Devonport and it was then accompanied by Bournon's catalogue (Church, 1877). All that now remains of it is in the Plymouth City Museum, where it is being carefully curated by the Keeper of Natural History. Two of the original volumes of Bournon's catalogue have been saved, though both Plymouth and Devonport suffered severely from bombing in the 1939–1945 war: xerographic copies are in the Mineralogy Library, British Museum (Natural History).

The Carne Collection now forms part of the mineral collection of the Department of Mineralogy and Petrology at Cambridge. Also in the same collection is that made by Sir Abraham Hume (1749–1838) which, together with his collection of diamonds (see p. 59), was presented to the University by Viscount Alford in 1841. The Mineral Collection in the British Museum which, up to the end of the eighteenth century, consisted almost entirely of the minerals from Sir Hans Sloane's collection, received three notable additions in the period 1799–1810. A collection containing many choice specimens formed by the Rev. Clayton Mordaunt Cracherode (1730–1799) was bequeathed to the British Museum in 1799. In that same year the Museum purchased the large collection of minerals and rocks formed by Charles Hatchett and which included a fine set of Russian minerals. A much larger addition was made in 1810 when the collection of Charles Francis Greville (1749–1809), said to contain 20 000 specimens, was purchased for the nation by a special vote of £13 727. By that time Charles Konig had been appointed an assistant in the Natural History Department and had been given charge of the Mineral Collection and its arrangement (Smith, 1969)[1].

The Rashleigh Collection, which, as mentioned above, was the earliest of the Cornish collections of this period, is important not only because it contained splendid specimens from Cornwall and from other parts of Britain and from abroad, but also because it was carefully catalogued by Rashleigh himself. The main part of this collection was acquired by the Royal Institution of

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[1] There was also in the Royal Institution founded by Count Rumford in 1799 'a museum of more than 3,000 mineral specimens and fossils, including a special collection of minerals, presented by Sir Humphry Davy' (Woodward, 1907 : 9). This may have been incorporated in the collections of the Geological Museum, Institute of Geological Sciences.

Cornwall and is in the County Museum and Art Gallery in Truro. The original catalogue, and also a later one compiled by Arthur Aikin in 1814, are preserved with the collection; a xerograph copy of Rashleigh's original catalogue is in the Department of Mineralogy at the British Museum (Natural History). Another part of the original collection, given during his lifetime by Rashleigh to his son Jonathan, was lost sight of until 1923 when it was traced and purchased by Sir Arthur Russell. The original catalogue contained entries for 3902 specimens. It followed a simple classification into 'ores of various metals, followed by the principal non-metallic species' (Russell, 1952a).

Philip Rashleigh himself published in two parts, in 1797 and 1802, a beautifully illustrated book entitled *Specimens of British minerals selected from the cabinet of Philip Rashleigh*.

Another collection, important also because it was accompanied by a contemporary catalogue, is that of Thomas Pennant (1726–1798). The collection did not contain many specimens remarkable for their beauty such as were found in Rashleigh's collection but it was rich in minerals from the mines of Pennant's home county, Flintshire. It had remained in its original cabinets for over a century since his death. The catalogue, in two volumes, by Pennant himself was started about 1757 and contains some 1250 entries. As mentioned above (p. 52) the classification 'favoured Woodward's System'. It is set out in full in a short account of Thomas Pennant written in 1913, the year in which the Earl of Denbigh presented the collection to the British Museum (Natural History) (Smith, 1913).

Crystal form did not enter into Pennant's classification though he did divide the Spars into: 'crystalliform or cubic' and 'Spars breaking into rhomboid or parallelopiped masses'. However, calcite specimens are found entered under both divisions and it is evident from an entry under *spatum Islandicum*, from Pen-y-Bryn mine, that he did not distinguish between cubic and rhombohedral cleavage. It is, however, perhaps only fair to remark that this was sixteen years before Torbern Bergman wrote his celebrated paper (1773) 'Variae crystallorum formae, a spatho ortae, explicatae', in which he demonstrated that prisms and scalenohedra of calcite could be built up from cleavage rhombohedra suitably arranged.

Other important collections made in the nineteenth century

The collecting of fine mineral specimens continued to be fashionable throughout the first half of the nineteenth century and was greatly stimulated by a celebrated mineral dealer, Henry Heuland. Sir Arthur Russell has given an interesting account of him (Russell, 1952b) and, more recently' Frondel (1972) and Whitehead (1973) have written about Heuland's uncle, Jacob Forster.

Forster's collection, with additional material supplied by Heuland, was sold in 1820 to C. H. Turner. Heuland employed Armand Lévy to compile an illustrated catalogue of the collection. Lévy began, but failed to complete it and the catalogue was finished by H. E. Brookes and published in three quarto volumes in 1838. This collection, and another made by William Nevill, was acquired by Henry Ludlam to add to his own already fine collection. The whole was bequeathed to the Museum of Practical Geology. At the time of Ludlam's early death in 1880 it was regarded as 'the most complete and probably the finest collection of minerals ever made by a private collector' (Davies, 1881).

A fine collection made by Lady Louisa Aylesford (1761–1832) was bought by Heuland, and specimens from it along with others from Heuland's own collection were auctioned at Heuland's sales between 1833 and 1839. Many were bought by the British Museum.

Another collection in which most of the specimens were bought at Heuland's sales between 1826 and 1847 was made by Isaac Walker (1793–1853) of Arnos Grove, Southgate, London, and added to, perhaps by his sons. It was purchased in 1912 by S. Henson, mineral dealer of London. Many of the finest specimens were acquired by the Department of Mineralogy, British Museum (Natural History), a considerable number being presented by F. N. Ashcroft (Anon., [Spencer], 1913a).

In Edinburgh Thomas Allan (see p. 60) was making a notable collection. He collected minerals in England, Ireland, and the Faroe Islands, as well as in Scotland. He had bought Giesecke's first Greenland collection (see p. 57), and Haidinger had travelled in Europe with young Robert

Allan (see p. 61) in about 1825 to procure more specimens. The whole collection was purchased in 1835 for £1300 by Robert Hyde Greg. It was added to later by his son R. P. Greg who, with W. G. Lettsom, was co-author of the *Manual of the mineralogy of Great Britain and Ireland* (1858). This collection, known as the Allan–Greg Collection, was acquired by the Department of Mineralogy of the British Museum in 1860. It was one of the earliest and perhaps the most important purchase arranged by Story-Maskelyne in his early years as Keeper of Minerals (see below, p. 68).

A large collection of minerals was made by Robert Jameson during the long period during which he was Regius Professor of Natural History in Edinburgh and it formed the main part of the general collection of minerals in the Royal Scottish Museum. It incorporated the still earlier collection made by Dr John Walker. He had published two editions of a classification of 'fossils' for use in the University (Sweet, 1963).

Elsewhere in Scotland, about the middle of the century, M. F. Heddle, then newly returned from studying at Clausthal and Freiberg, was adding to his earlier collection of Scottish minerals, collecting much material from the islands as well as from the mainland. After 1850 he was often accompanied by his friend Patrick Dudgeon of Cargen, who had himself built up a fine collection of minerals which he gave to the nation in 1890 (Heddle, 1897). Heddle's Collection was also acquired by the Edinburgh Museum of Science and Art, now the Royal Scottish Museum, partly by purchase and partly by gift. It was arranged by Heddle himself a year or so before his death in 1897 (Goodchild, 1900).

Another collection of minerals, probably chosen mainly for their aesthetic appeal, was made by John Ruskin who as a student at Oxford had attended Buckland's lectures on geology and mineralogy in 1837. His published diaries show that in 1866 and 1868 he was buying specimens from such well-known dealers as Bryce Wright, Tennant, and Talling of Lostwithiel, and that at that time he was living at Denmark Hill in South London. He retired to Brantwood on Lake Coniston, in the English Lake District, in 1884 and at about that time he presented specimens to the British Museum (Natural History), St David's School, Reigate, and the Kirkcudbright Museum, each collection being provided with a catalogue. Other specimens were presented to the St George's Guild and to the Museum of Science and Art at Sheffield. Many specimens once belonging to Ruskin came to the Mineral Collection in the University Museum at Oxford when the collection of Mr George Allen of Orpington, Kent, was purchased in 1908. The main part of the collection that remained at Brantwood was bought by Sir Arthur Russell in 1931.

In north-east England there were many collections of minerals, some rich in the minerals of the mines of Yorkshire and Durham. I have no personal knowledge of these collections except that made by C. O. Trechmann (1851–1917) part of which, including many specimens of the sulpharsenites of the Binnenthal, was bequeathed to the British Museum (Natural History) in 1917, and a greater part presented by his son C. T. Trechmann in 1926.

At Chatsworth there was a collection of specimens from the mines owned by the Dukes of Devonshire which included some fine and large specimens.

William Phillips' mineral collection (see p. 65) which was sold by private treaty at Sotheby's in London in 1829 was purchased by Dr Rutter of Liverpool. He presented it to the Medical Institution of Liverpool and eventually it was transferred to the Liverpool Museum. It consisted of small, mostly well-crystallized specimens. Many of the crystals had been measured by Phillips and the results published in his books. It was destroyed by bombing in May 1941.

There was also a mineral collection at Alnwick Castle made by the Duchess of Northumberland, Lady Charlotte Patricia Clive, who married the 3rd Duke in 1817. This was part of a larger collection of natural history specimens and 'Curiosities' sold by auction at Sotheby's on 9 July 1968. Among the specimens were ores from Alston Moor, fluorite from Allenheads, malachite and beryl from Siberia, rock crystal, axinite from Dauphiné, calcite from Andreasberg, and two gold nuggets from Co. Wicklow.

A collection of minerals and fossils was located at Wallington Hall, one of the homes of Sir Walter C. Trevelyan (1797–1879), primarily a botanist but also an active geologist. He presented many specimens to the Museum of the Natural History Society of Northumberland, Durham, and Newcastle upon Tyne, now the Hancock Museum, in Newcastle upon Tyne.

For notes on other collections in the Hancock Museum I am greatly indebted to Miss Susan Turner of that Museum. A very early collection, containing some minerals, is the Cookson Collection which seems to have been in existence at least since 1743. Some fine specimens were presented by Thomas Sopwith (1803–1879), manager of Beaumont's mines in Allendale from 1845 to 1871. More important, however, is the collection formed by William Hutton (1798–1860) which was on loan to the Hancock Museum from 1831. After Hutton's death it was purchased from the executors by Sir William Armstrong and presented by him to the Museum in 1880. It is rich in minerals from the north of England, including well-known localities in Weardale, Alston, and Carrock Fell. It was owing to Hutton's efforts that 'a splendid collection of minerals and geological specimens illustrative of the mineral productions of the Russian Empire made by the command of His Imperial Majesty, Tsar Nicholas I, and presented by him to the Society [The Natural History Society of Northumberland, Durham, and Newcastle upon Tyne]' was secured for the Museum on 15 October 1838. This collection was catalogued by the late Dr S. I. Tomkeieff in 1935.

Early mineral analysts

By the end of the eighteenth century some chemists in England were becoming interested in the analysis of mineral substances. Such was William Gregor, a Cornishman, born in 1761, a graduate of St John's College, Cambridge, and for many years Vicar of Creed, near Grampound, Cornwall. As a result of his analyses of menaccanite from a stream-bed at Menaccan he discovered a new metal, later re-discovered by Klaproth and by him named titanium (Russell, 1955).

Other chemists in London, chiefly interested in the analysis of mineral substances, formed, in 1799, the British Mineralogical Society, in a sense the predecessor of the present Mineralogical Society. The Minute Book of the Society is in the Mineralogy Library, British Museum (Natural History). An account of its brief existence (1799–1806) is given by Professor W. W. Watts in his address on the occasion of the Jubilee meeting of the Mineralogical Society (Watts, 1926 : 108–109). Among the members of this earlier Society was Charles Hatchett who had sold his collection of minerals to the British Museum in 1799 (see p. 53). Three years previously he had made a remarkable journey through England and Scotland visiting mines, smelting works and foundries and recording his observations (Raistrick, 1967). Hatchett was the discoverer of columbium (1802a); the story of this discovery has been told by Miss J. M. Sweet (1935), whose account of the Sloane minerals has been referred to above (p. 51).

Hatchett published numerous analyses of minerals between 1797 and 1804, the first, read before the Linnean Society, being 'On bituminous substances . . .' (Hatchett, 1798). His papers on columbite and columbium appeared later (Hatchett, 1802a, b). Unfortunately he seems to have given up chemical analysis a few years after this.

While members of the British Mineralogical Society were active in London there was working in Scotland, and for a time also in London, a chemist and mineralogist, Thomas Thomson (1773–1852). In his younger days he was a friend of John Dalton and of Wollaston and is credited with some share with them through his work on oxalic acid and certain oxalates, in the establishment of the Law of Multiple Proportions (Thomson, 1808a, b). He also published a *System of chemistry* in 1802 and lectured on chemistry in Edinburgh; in 1807 he opened a laboratory for practical instruction. He was editor of *Annals of Philosophy* from 1813 to 1820, went to Glasgow as a lecturer in 1817 and was appointed the first Professor of Chemistry there in 1818.

In 1836 he published *Outlines of mineralogy, geology and mineral analysis* in two volumes. The first volume, on mineralogy, is noticed later. Part 3, dealing with the methods of analysing minerals, has an introduction giving a history of mineral analysis and of the methods and recent improvements by European chemists including Berzelius and his pupils, Gmelin, Klaproth and H. Rose. Of British contributions he wrote: 'If we except Mr Hatchett and Mr Chenevix, Great Britain has produced very few analytical chemists. Almost the only modern chemists . . . who have published analyses of minerals are Mr R. Phillips, Dr Turner and Mr Connell.' Among Thomson's numerous mineral analyses are those of a native carbonate of strontium from Strontian (1816), of emmonite, a variety of strontianite from Massachusetts, and of holmite

(=seybertite), a brittle mica. He wrote also more general papers giving mineralogical observations on Cornwall (1814) and on minerals from the neighbourhood of Glasgow (1840), and in a paper on 'The needlestone from Kilpatrick in Dumbartonshire' (1820), he presented an extensive study of various zeolites: natrolite, scolecite, mesolite, and thomsonite, the last named for him by H. J. Brooke.

Between 1811 and 1816 he published in the *Memoirs of the Edinburgh Wernerian Society* three analyses of minerals from Greenland: sodalite, allanite, and magnetic iron-ore. Sodalite and allanite were new minerals, the latter named in honour of Thomas Allan of Edinburgh.

The history of these specimens is sufficiently interesting to allow a digression from the subject of early mineral analysts. A Danish ship, on its way from Iceland to Copenhagen, was captured by a French privateer, retaken by a British frigate and brought to Leith harbour. In the cargo was a collection of minerals which was sold by auction and bought for £40 by Thomas Allan, an Edinburgh banker, and Colonel Imrie. All that was known about the collection was that it had been shipped by a missionary from a harbour on Davis Straits. Allan concluded from the abundance of specimens of cryolite in the collection that it had come from Greenland and it subsequently transpired that it had been made by Karl Ludwig Metzler (afterwards Giesecke) during a six years' residence in Greenland. In 1813 Giesecke returned with another collection and visited Allan in Edinburgh. Soon after this, perhaps helped by Allan, he was appointed Professor of Mineralogy to the Royal Dublin Society (Sweet, 1967, 1974; Greenough, 1838).

Another Scottish chemist, who made many contributions to the analysis of minerals, was James Finlay Weir Johnston, born in Paisley in 1796. He had studied at Glasgow University, and was a pupil of Berzelius in 1812. In 1833 he became the first Reader in Chemistry and Mineralogy in the University of Durham, and was also Chemist to the Agricultural Society of Scotland. Among his numerous papers are two on minerals named by him: plumbocalcite (Johnston, 1832), and barytocalcite (=alstonite) and its dimorphism (Johnston, 1835). He reported the discovery of vanadium in Scotland and a vanadate of lead (1831), and described various hydrocarbons and mineral resins among which middletonite (1838a), guyaquillite (1838b) (the present spelling is guayaquilite), and pigotite (1840) were named by him as new.

Blow-pipe analysis seems to have been well developed in Britain for the determination of minerals. Edward Daniel Clarke, the first Professor of Mineralogy at Cambridge, became an internationally recognized authority on the 'gas blow-pipe', and J. G. Children, in 1822 an 'Assistant Librarian' in the Natural History Department of the British Museum, translated, through the French translation by Fresnel, a book on the use of the blow-pipe by J. J. Berzelius which had been published in 1820 (Children, 1822). In the *Elementary introduction to . . . mineralogy*, third edition, 1823, by William Phillips, there is a description of the methods of blow-pipe analysis as applied to minerals complete with details for beginners on how to 'blow' so as to produce 'from the flame of a common candle, a steady stream of flame': quite a difficult accomplishment.

Richard Kirwan F.R.S. (1733–1812), studied chemistry for some time in London but settled in Dublin in 1789 and became President of the Dublin Society (Sweet, 1967 : 122). In the second edition of his *Elements of mineralogy*, 1794–1796, whilst tracing the growth of mineralogy as a science, he refers to the debt the science owed in the decade 1774–1784 to Scheele and to Bergman, and in the subsequent period to Klaproth and to Werner. Had he been writing a little later he would surely have added 'and to Berzelius' for, far more important than Berzelius' work on blow-pipe analysis, just referred to, were the great improvements he introduced in the methods of gravimetric analysis. The high standards obtained by him must have given to mineralogists in this country a great incentive to achieve better analyses themselves.

We know of at least two early links with Berzelius, both from Scotland. One was J. F. W. Johnston, already mentioned, who was a pupil of Berzelius in 1812; the other a Scottish physician, William MacMichael, 'who worked in Berzelius' laboratory learning analytical procedures' in the winter of 1812/1813 (or 1813/1814). It is recorded that he stimulated his host's interest in mineralogy by giving him a collection of minerals he had bought, after he had selected those he wanted for the British Museum; and with reference to this incident Berzelius noted 'I accepted his friendly gift. Some time later, in order to arrange my collection, I began to study mineralogy.'

The further progress and improvements in the chemical analysis of minerals has recently been very well reviewed by Dr M. H. Hey in his Hallimond lecture to the Mineralogical Society (Hey, 1973), and though more is said later on British contributions to the chemistry and to classification based mainly on chemical composition one must give some account at this point of the influence of A. G. Werner on British mineralogists about the turn of the century.

The influence of Werner on the classification of minerals

Abraham Gottlob Werner had been appointed Inspector of Mining and Instructor in Mineralogy at the Mining Academy in Freiberg in 1775, at the age of 25. His great reputation as a teacher is always associated by geologists with the Neptunian or Plutonist controversy around which so many heated arguments arose in the early part of the nineteenth century, and in which both Richard Kirwan and Robert Jameson took very active parts. However, this discussion concerned mainly 'geognosy' and what is now called 'petrology', and Werner's great contribution to mineralogy is his first book: *Von den äusserlichen Kennzeichen der Fossilien*, published in 1774, of which a new translation by A. V. Carozzi has recently appeared (Werner [1962]).

The controversy which raged in Edinburgh between supporters of Werner and those of James Hutton indirectly did a considerable service to mineralogy and petrology, for it inspired Sir James Hall, a friend of Hutton's in Edinburgh, to make experiments on the fusibility of certain lavas, basalts, and dolerites, by which he demonstrated that on being cooled very slowly the fused products solidified not wholly as glass but were partly crystallized and stony (Hall, 1805). Later under extremely difficult experimental conditions he studied the effect of heating powdered limestone and chalk to high temperatures under pressure and showed that they could be melted under these conditions without dissociating (Hall, 1812). Thus, as Sir John Flett pointed out, he became the founder of experimental petrology although very many years were to elapse before his work was followed up with the much better facilities available in modern laboratories (Flett, 1922; see also Eyles, 1963; and Sweet & Waterston, 1967).

Hall began his experiments about 1790 but, apart from a paper read to the Royal Society of Edinburgh in that year, he refrained from publishing his results in full until after Hutton's death in 1797. In the meantime his experiments on the fusion of basalt had been repeated by Gregory Watt, using Clee Hill dolerite in very large quantities, one or two hundredweight at a time (Watt, 1804).

To return to Werner's first book *On the external characters of minerals*: this has been described as a manual of determinative mineralogy, utilizing the external characteristics, colour, form, lustre, streak, hardness, and specific gravity (Eyles, 1964). Werner's method of identifying minerals could be studied by means of collections of specimens selected to illustrate the 'characteristics' relied on to distinguish one mineral from another. Such was the first of the five 'Collections' comprising the Leskean Collection formed by N. G. Leske, a Professor of Natural History in Leipzig in 1775, and a friend of Werner's from their student days.

One of the earliest personal contacts made with Werner by any mineralogist in the British Isles seems to have been by Richard Kirwan (see p. 57) who visited him in Freiberg and through him was able, in 1792, to arrange for the purchase by the Royal Dublin Society of the Leskean Collection. Kirwan intended this collection to be used in the teaching of mineralogy at the Mining Academy which it was proposed to form in Dublin. George Mitchell, a native of Belfast, and a student and graduate of the University of Dublin, worked there on the Leskean Collection and translated Karsten's catalogue of it in 1798.

In the previous year Robert Jameson visited Dublin and spent eight days carefully examining the Leskean Cabinet with Kirwan and Mitchell. He found some of the colour differences too minute; also among the different kinds of 'fractures' he 'found some beautiful distinctions but in many instances run into by few too great minuteness' [*sic*] (Sweet, 1967).

It was probably Jameson's meetings and discussions with Kirwan and Mitchell that encouraged him to enrol in 1800 as a student at Freiberg, where George Mitchell had also matriculated in 1798. Mitchell became one of Werner's favourite and most promising pupils. Unfortunately he died in 1803, and the Dublin Mining Academy was never established.

A year or two after his return from Freiberg, Robert Jameson was appointed Professor of Natural History in the University of Edinburgh. He had already published *An outline of the mineralogy of the Shetland Islands, and of the island of Arran* (1798); and also *Mineralogy of the Scottish Isles* in two volumes (1800). Both of these were written before his Freiberg visit, but his more important, three-volume *System of mineralogy* (1804) belongs to his 'Wernerian' period. In the preface to this work, he reviews the classifications of Cronstedt and Wallerius and introduces Werner's classification which he then adopts. In the following year he published *A treatise on the external characters of minerals.*

In Glasgow there was another supporter of Werner's system, the chemist Thomas Thomson, mentioned above (p. 56). He was a Vice-President of Jameson's Wernerian Natural History Society, and in the first volume of his *Annals of philosophy* (1813) he published a lengthy and somewhat violent attack on Richard Chenevix who, writing in Paris in the *Annales de chemie* in 1808, had criticized Werner's system of mineral classification and extolled that of Haüy.

Richard Kirwan published the first edition of his *Elements of mineralogy* in London in 1784, before his meetings with Werner. In this he follows the system of Cronstedt, 'founded almost entirely on chemical characters' as being 'received by all Europe', but he refers also to 'classification by external characters of which some able patrons have appeared of late among whom I shall mention only Werner and Mr Romé de Lisle'. In his second edition, however, he follows Werner's method.

Neither in Cambridge nor in Oxford were there active enthusiasts for Werner's methods. E. D. Clarke, the first Professor of Mineralogy in Cambridge, had learnt some crystallography from Haüy in Paris and probably left the classification of rocks to the Woodwardian Professor. However, I am indebted to Dr Roy Porter for pointing out that John Hailstone, Woodwardian Professor at Cambridge before Sedgwick, had studied at Freiberg and that his *Plan of a course of lectures in mineralogy* (1792) is highly Wernerian in tone and emphasis. It appears, however, that 'although he gave demonstrations to residents and strangers who visited the Woodwardian Museum, he never gave a single lecture' (Woodward, 1907 : 54). Meanwhile, in Oxford, John Kidd, the Professor of Chemistry, had carried on the teaching of mineralogy and geology begun by Sir Christopher Pegge, Professor of Physic. Kidd's teaching was given in a subterranean classroom under the Ashmolean Museum where 'nearly all the scientific teaching at Oxford had been accomplished since the days of Robert Plot' (Gunther, 1925 : 266). Kidd, in his *Outlines of mineralogy*, which he published in 1809, while acknowledging his indebtedness to Haüy, Brongniart, and Kirwan, followed a classification of his own. Kidd's famous successor, William Buckland, had he entered into the Wernerian controversy, would have been a 'plutonist'.

Systems of mineralogy and text-books

In London mineralogists, many of them members of the British Mineralogical Society (see p. 56), seem to have been interested chiefly in the minerals themselves, their chemistry, and crystal form. They had contacts with Europe, particularly with France, in spite of the wars, and they were hearing of the publications of Romé de l'Isle and the newer writings and teaching of the Abbé Haüy in Paris (Haüy, 1822). Haüy was able to send to Sir Joseph Banks in 1809 three copies of his *Tableau comparatif des résultats de la cristallographie et de l'analyse chimique relativement à la classification de minéraux*. One copy was for Greville, one for Bournon, and the third for Banks himself. This copy Banks put at the disposal of his geologist friends in his library. It is now in the library of the Department of Mineralogy in the British Museum (Natural History) (de Beer, 1960 : 184).

The rapid increase in interest among London mineralogists in minerals and crystals was partly, and perhaps mainly, due to the arrival in 1794 of a French royalist refugee Jacques Louis, Comte de Bournon, a pupil of Romé de l'Isle. He was soon employed 'curating' the mineral collections of Sir John St Aubyn, Sir Abraham Hume, of whose diamond collection he published a catalogue in 1815 (see p. 53), and the great collection of the Rt Hon. Charles Francis Greville (Woodward, 1907). Also he gave lectures in London, where he became associated with the leading mineralogists. Among these was William Babington, a busy London doctor, who arranged meetings of his mineralogical friends at seven in the morning to fit them in before his patients claimed his attention (Whewell, 1842 : 65).

From these friends Babington raised a fund for the publication of Bournon's monograph on the crystal forms of carbonate of lime (Bournon, 1808). The original sponsors with Babington were William Allen and William and Richard Philips, and the other subscribers were: Sir John St Aubyn, Robert Ferguson, G. B. Greenough, Charles Francis Greville, Charles Hatchett, Luke Howard, Sir Abraham Hume, Richard Knight, Richard Laird, and John Williams, Jr. There were also Dr Crichton, Physician to the Emperor of Russia, and three other Russian patrons of science (Greenough, 1838 : 42).

Bournon had also been engaged by E. W. Gray, head of the Natural History Departments in the British Museum, to give help in selecting specimens from the Collection of Minerals for preservation, for duplicates, or for rejects, and in working on the catalogue. This engagement seems to have ended with the death of Gray in 1806.

When the Greville Collection of minerals was purchased in 1810 (see p. 53) Bournon hoped he would be put in charge of its removal from Greville's house to the British Museum. In the event the removal was done by the recently appointed 'assistant librarian', Charles Konig. Bournon complained that his 'tickets' were displaced, and certainly the only relic we have of Bournon's twelve years' work for Greville is a set of crystal models in wood accompanied by labels in Bournon's handwriting.

Perhaps it was the growing popularity of minerals among amateur collectors and students of the work of Romé de l'Isle and of Haüy that induced James Sowerby (1757–1822), first of a long line of naturalists, to produce his *British mineralogy*, with 550 plates in colour and descriptions of the specimens illustrated. This work ran to five volumes, the first appearing in 1804 and the last in 1817. He also published in 27 numbers *Exotic mineralogy* . . ., as a supplement to *British mineralogy* (Sowerby, 1811–1817 [1820]). The plates in *British mineralogy* were not arranged in any systematic order but there was a systematic index with each volume and this was completely revised in volume 5 and a separate, systematic *Catalogue of British minerals* was published in 1819 as a kind of appendix, to be used in making out labels for specimens in mineral collections (Sowerby, 1819).

Others attempted similar 'systems' to help collectors in the baffling task of arranging their specimens. William Babington had published *A systematic arrangement of minerals* in 1795, and an enlarged edition in 1799. This is described on the title page as being 'in the form of a catalogue after the manner of Baron Born's systematic catalogue of the collection of fossils of Mlle Eléonore de Raab'. The first edition seems to have been written when the author was arranging the mineral collection of the Earl of Bute; according to Greenough, Babington had purchased the Earl of Bute's collection, 'the finest, perhaps, which at that time existed in England' (Greenough, 1838 : 5). This collection passed into the possession of Sir John St Aubyn to whom the second edition of Babington's work was dedicated (see p. 53).

Arthur Aikin had also attempted a system, under which minerals could be arranged, in his *Manual of mineralogy* in 1814; this book included the substance of lectures given in the winter of 1813–1814 to some members of the Geological Society. He had been President of the British Mineralogical Society, and was Secretary of the Geological Society from 1812 to 1819. Aikin gave a general synopsis setting out a classification under which the minerals are described and chemical analyses quoted. The introduction discussed the characters of minerals and the means of testing them, with instructions on the use of the blow-pipe.

Thomas Allan in Edinburgh had published in 1808 *An alphabetical list of the names of minerals . . . with tables of analyses* and another edition in quarto in 1819 giving more space to the columns showing chemical composition. The names were listed in groups of: Saline minerals, Earthy minerals, Inflammables (Amber, Bitumen, Coal, etc.), and Metallic minerals. Synonyms were cross-indexed.

Another systematic mineralogy following to some extent the system of Werner was *The characteristic of the natural history system of mineralogy* by Friedrich Mohs. He was one of Werner's most successful students and succeeded him as professor in the Mining Academy of Freiberg. An English translation of this work was published in Edinburgh (Mohs, 1820a, b).

Lastly, one may mention the system of Berzelius 'based on his electro-chemical theory and the doctrine of definite proportions' (Berzelius, 1814). This was published first in 1814 but was later (1824) modified as a result of Mitscherlich's discovery of isomorphism. This modified system 'with occasional slight deviations' was adopted by Konig for the rearrangement of the British Museum collection of minerals in 1828 (Smith, 1969 : 249).

Whewell, who, in his report on the recent progress and present state of mineralogy (1833), had given a critical review of the various systems of classification that had been proposed by European mineralogists, while paying tribute to Mohs as well as to Berzelius and Beudant, thoroughly approved of Konig's adoption of the Berzelius system (Whewell, 1833 : 360). He had made an attempt at a system of classification himself in 1828 but probably he was far from satisfied with it for, with unusual modesty, he made no mention of it in his own review of the numerous classifications devised by others. A. J. Berry has given a brief account of it in his oft-quoted review of mineralogy in Cambridge. 'In the long introduction the author states that it is not his intention to propose a new system of classification, but rather to work out a system of nomenclature along the lines adopted by Linnaeus in botany, and to correlate these orders and species with the chemical constitution of the minerals. He used modifications of the names adopted by Mohs . . . and related these to the chemical composition obtained by Berzelius and others' (Berry, 1960 : 7).

A work belonging to a later period which aimed at providing a key to the identification of minerals was published in London in 1843 by E. J. Chapman, a young mineralogist who found previous authors' methods unacceptable. It was entitled *Practical mineralogy, or a compendium of the distinguishing characters of minerals by which the name of any species or variety in the mineral kingdom may be speedily ascertained.* Chapman was then 22 and an engineer; later he lectured on minerals at University College London and became Professor of Mineralogy and Geology at Toronto from 1853 to 1895.

Other books on mineralogy, more concerned with the description of minerals, to some extent with crystallography, and with localities at which the minerals were known to occur, soon became available in England and Scotland. Early and important among these is William Phillips' *Elementary introduction to the knowledge of mineralogy*, first published in 1816. A second edition appeared three years later and a third in 1823. Phillips' work will be referred to again below.

A little later appeared Haidinger's translation of Mohs' *Grund-Riss der Mineralogie*, published in Edinburgh in 1825 and followed, also in Edinburgh in 1834, by Robert Allan's *Manual of mineralogy*. This Robert (1806–1863) was the eldest son of Thomas Allan at whose invitation Haidinger had come to Edinburgh to translate Mohs' work. With his father and Haidinger he had visited the Cornish mines in 1821. He studied crystallography with Haidinger and with him toured the mines and mining academies of Europe, visiting also the volcanoes of Italy and Sicily in 1825–1826. With his father's splendid collection available for study he was well equipped for his task and his *Manual* must have been a very useful text-book. He went on in 1837 to publish a fourth edition of Phillips' *Elementary introduction*. In his own *Manual* he had discussed classification and concluded that until chemical composition was better known the Natural Historical System of Mohs was adequate though confessedly defective. In his edition of Phillips, however, he retained Phillips' own arrangement, contenting himself with the addition of some 150 more minerals and many figures of crystals in the text. By curtailing the descriptions of mere varieties he produced a volume not very much larger than the third edition.

Other text-books of mineralogy emanated from Scotland in the first half of the nineteenth century. Perhaps the most considerable was *Outlines of mineralogy, geology and mineral analysis* in two volumes by Thomas Thomson of Glasgow (see p. 56), published in London in 1836. The work had been ten years in preparation. The *Outlines of mineralogy* (Volume 1, 726 pp.) contains an introductory discussion of the characters of minerals and Mohs' system of classification. Thomson himself opts for a chemical arrangement, classifying minerals in genera under three classes: acid bases, alkaline bases, and neutral bases. Descriptions of the minerals included notes on chemical constituents, and on the simple crystal forms, and there are extensive tables in an appendix. The first of these tables lists for all the minerals: specific gravity, hardness and, where known, the primary crystal form. Two others give lists of minerals in order of increasing specific gravity from scheererite to native iridium, and in order of increasing hardness.

A few years later, in 1849, James Nicol, at that time Professor of Geology at Queen's College, Cork, published in Edinburgh a *Manual of mineralogy*. His *Elements of mineralogy* followed in 1858, when he was Professor of Natural History at Marischal College, Aberdeen.

In England, in that same year of 1858, there appeared Greg & Lettsom's *Manual of the mineralogy of Great Britain and Ireland* the first and only British mineralogy since Sowerby, except for *The mineralogists' directory* by Townshend M. Hall (Hall, 1868) and F. W. Rudler's *Handbook to a collection of the minerals of the British Islands, mostly selected from the Ludlam Collection* . . . (1905).

The teaching of mineralogy in the nineteenth century

Evidence of the growing interest in mineralogy is found in the preface to the second edition of William Phillips' *Elementary introduction to the knowledge of mineralogy* (1819), where he is able to record not only that 'lectures are given at public institutions' in London, but he also lists three persons in the metropolis who give private instruction in crystallography. One of these was Thomas Webster, the curator of the Geological Society's Collection (1812) and draughtsman to the Society, whilst another was Mrs Lowry of Titchfield Street, whose daughter Devalle Lowry wrote a popular book in two volumes entitled *Conversations in mineralogy* (1822). Furthermore, 'models cut in box-wood with great accuracy and beauty by N. J. Larkin, may be had of Bate in The Poultry and Mawe in the Strand, at one guinea each, as well as complete sets of models of all crystals described by Haüy in his *Treatise on Mineralogy* at the price of sixteen pounds the set'. John Mawe, a mineral dealer, had published small books on mineralogy and mining. One of these on *The mineralogy of Derbyshire* (1802) gave a description of mines in the north of England, in Scotland, and in Wales, including Ecton, and Parys mine in Anglesey, and also 'an analysis of Mr Williams's work intitled '*The Mineral Kingdom*'' (Williams, 1789, 1810).

In London colleges mineralogy was probably not taught apart from geology. University College, founded in 1826, did not establish a Chair in Geology until 1841, although the question had been discussed in 1828. At that time, according to Prestwich, the only nominal instruction in geology and mineralogy was to be had in three lectures by Dr [Edward] Turner at the end of his course on chemistry. John Phillips gave a course of twelve lectures there in 1831 but these were all on geology (Edmonds, 1975). The first professor appointed at the College was Thomas Webster, referred to above and he probably included mineralogy in his course.

We know that E. J. Chapman taught mineralogy in the College for a time before he went to Toronto in 1853 (p. 61) and T. G. Bonney, Professor of Geology from 1877–1905, could hardly have resisted giving some lectures on petrology, of which he was one of the pioneers.

King's College, founded two years later than University College, had Sir Charles Lyell (1831–1834), John Phillips (1834–1840), and D. T. Ansted (1840–1853) as its first three geology professors. Of these Ansted also practised as a consulting geologist and mining engineer, and his successor James Tennant (1853–1869) was a well-known mineralogist and mineral dealer. For a time, after the death of Charles Konig in 1851, he had been curating the Mineral Collection in the British Museum.

This seems the place to record also the work of F. Rutley and F. W. Rudler. The former was a lecturer in the Royal School of Mines in 1882 under J. W. Judd, who had been appointed professor there in 1876. Rudler had been lecturer in Natural Sciences in the University College of Wales, Aberystwyth, from 1876 to 1879 when he returned to his earlier appointment of curator of the old 'Jermyn Street' Museum of Practical Geology. He had made his first catalogue of the collections there in 1864.

Away from the metropolis Durham had a Reader in Mineralogy, J. F. W. Johnston, from 1833 (see p. 57). In Scotland, Robert Jameson, Professor of Natural History in Edinburgh from 1804, inspired great interest by his lectures on mineralogy and geology and continued to do so until 1847 when deteriorating health limited his activities. He died aged 80 in 1854. The Regius Professorship of Geology in Edinburgh was not founded until 1871 and Sir Archibald Geikie was the first occupant of the chair.

In St Andrews, M. Forster Heddle, already an enthusiastic mineralogist, succeeded to the Professorship of Chemistry in 1862. Whilst there he made, and had made, a great number of mineral analyses. He relinquished the Professorship in 1883 but soon returned to St Andrews devoting himself to adding to his collection of minerals, to writing, and to working on his *Mineralogy of Scotland*, which was published in 1901, four years after his death.

Glasgow had appointed Thomas Thomson Professor of Chemistry in 1817 and doubtless he gave lectures on mineralogy and mineral analyses on the lines of his *Outlines of mineralogy, geology, and mineral analysis* published in 1836 (see p. 56).

The important part played by the Royal Dublin Society in promoting the study of mineralogy has been described above (p. 57). Here William Higgins, who had followed Kirwan to Dublin in 1792, became curator of the Leskean Collection of Minerals in 1795 and subsequently Professor of Chemistry and Mineralogy. In 1812 a separate Professorship of Mineralogy was decided on. The post was offered to Robert Jameson who appears to have accepted it, but he was prevented from taking up the post and it was then offered to Charles Louis (Lewis) Giesecke. He was appointed in 1814, and his lectures and teaching of mineralogy became famous (p. 57). On his death in 1833 Dr John Scouler, Professor of Natural History in Glasgow, took his place. Queen's College, Cork, then the Cork Institution, had a lectureship in mineralogy for which we learn one of Jameson's students, James Ogilby, had applied in 1816 (Sweet, 1967, 1974). James Nicol was Professor of Geology there in 1849.

At Trinity College, Dublin, Samuel Haughton had succeeded Thomas Oldham as Professor of Geology and held the post from 1851 to 1881. His work in mineralogy was chiefly concerned with chemical petrology. He was an original member of the Mineralogical Society.

The teaching of mineralogy formed part of the wider instruction in mining which was organized in Cornwall at Truro, Redruth, Penzance, and Camborne at various times from 1838 onwards. A mining school for part-time students was established in Truro in 1838 by Sir Charles Lemon and was carried on for some years at his expense. Additional information on this subject has been provided by Dr L. P. S. Piper, Vice-Principal of the Cornwall Technical College at Redruth, who reviewed the history of technical education in Cornwall, and has recently published 'A short history of the Camborne School of Mines' (Piper, 1975).

In 1859 the Miners' Association of Devon and Cornwall was founded, largely through the initiative of Robert Hunt and the Fox family of Falmouth. Mining classes were arranged in Camborne, Redruth, and Penzance and many distinguished lecturers were engaged. These included Richard Pearce, Robert Hunt, Sir Warrington Smyth, Sir Clement le Neve Foster (1865–1867), and J. H. Collins (1868–1870). The Camborne School of Metalliferous Mining was founded in 1888, partly through the efforts of J. J. Beringer who became its Principal in 1892 and so remained until 1910, when the School was taken over by the County Council of Cornwall. Beringer continued as Vice-Principal until his death in 1915. Others who taught mineralogy in this school in recent years were H. R. Beringer, brother of J. J., E. H. Davison, John Robson, and K. F. G. Hosking.

In Penzance A. K. Barnett was lecturing on mining in 1873, holding his classes in the rooms of the Royal Geological Society of Cornwall. He had been a student under both le Neve Foster and J. H. Collins. In 1890 the Penzance Mining School was opened and it was due to Barnett's enthusiasm that this school survived. In the opinion of Dr Piper, Vice-Principal of Cornwall Technical College, A. K. Barnett was to Penzance what J. J. Beringer was to Camborne (Piper, L. P. S., pers. comm.).

Some reference has already been made to the teaching of mineralogy at Cambridge and Oxford in the early years of the nineteenth century (p. 59). The first professor of the subject at Cambridge, Edward Daniel Clarke, began to give lectures on minerals in 1807 and their success was such that a Chair in Mineralogy was founded in the following year. He published a syllabus of his proposed lectures in the preface to which he gave some idea of their scope and aims. To quote from A. J. Berry's *Sketch of the study of crystallography and mineralogy in Cambridge* (Berry, 1960), his principal object was to 'call the attention of the University to the history of the materials used by architects, sculptors and lapidaries, in the remotest periods, and in modern times; the mineralogy of the ancient poets and historians; and then finally to suggest the means of pursuing this branch of knowledge without the expense and encumbrance which have usually been its attendants'.

Clarke also published *A methodical distribution of the mineral kingdom* (1806) devised by himself, the divisions of which were, to quote his own words 'as old as the time of Avicenna (979–1037), and which with little variety have been adopted by almost all succeeding writers' (Clarke, 1818).

Clarke died in 1822 when only 53; he was succeeded by J. S. Henslow, naturalist and botanist, who became Professor of Botany in 1825. His place was taken by William Whewell, later (1841) to become a famous Master of Trinity, a brilliant mathematician who had been attracted by the symmetry of crystals and had turned his attention to crystallography. Under Whewell the teaching of mineralogy at Cambridge developed in the crystallographic direction and so continued for very many years under W. H. Miller (1832–1880) and W. J. Lewis (1881–1926).

In Oxford the same thing happened, though at a later date. William Buckland, who had carried on the teaching after John Kidd from 1813, had handed over the duties of Reader in Mineralogy in 1850 to one of his pupils, Nevil Story-Maskelyne, a grandson of Nevil Maskelyne, the Astronomer-Royal. He graduated in mathematics in 1845, but was also actively interested in science, and he had worked for a time in Faraday's laboratory at the Royal Institution in London. He was officially appointed Reader in Mineralogy in 1856 and became the first Professor of Mineralogy in 1861 when the Waynflete Chair was founded. His main interest was the study and teaching of crystallography.

Maskelyne's duties as Professor were not such as to necessitate his residence in Oxford for long periods and thus he was able to accept an appointment as Keeper of Minerals in the British Museum in 1857 when the former Department of Mineralogy and Geology was made into two separate departments. He resigned this Museum appointment in 1880 but he continued as Professor at Oxford until 1895. He numbered among his pupils L. Fletcher, W. J. Lewis, and H. A. Miers (Anon. [Spencer], 1913b).

Thus in Cambridge and in Oxford the teaching of crystallography was well established and it is to the further development of crystallography in Great Britain that one can now turn.

The development of crystallography

Romé de l'Isle and Haüy had established their 'laws' by observing and measuring a great number of crystals and cleavage forms: Romé de l'Isle, for example, had described over four hundred crystal forms. All their measurements had been made with a contact goniometer designed by Carangeot. With well-developed crystals or good cleavage forms it was possible to get tolerably reliable measurements but it was a tedious process and one needed to be quite adept at handling the crystal and the instrument, and the accuracy obtainable was not good. Miers (1902 : 100, fig. 200) illustrates a contact goniometer exactly like Haüy's. It was given by the Duke of Buckingham in 1824 to Buckland, Reader in Mineralogy and Professor of Geology at Oxford. The Duke bought Haüy's collection of minerals in 1822 (Smith 1969 : 247).

One can imagine how slowly crystallography would have developed if the only instrument for the measurement of crystals had been goniometers of the contact type. Fortunately, the situation was saved by the invention by W. H. Wollaston in 1809 of the reflecting goniometer familiar now to every student of mineralogy (Wollaston, 1809). With this instrument very good accuracy can be obtained and very small crystals can be measured. In his report on the state of mineralogy made to the British Association in 1832 William Whewell wrote: 'The invention of the reflecting goniometer by Dr Wollaston, was an invaluable gift to the crystallometer; and every step of our progress makes us more sensible of the importance of this elegant and well-designed instrument' (Whewell, 1833 : 352). Later Whewell wrote: 'Wollaston by the invention of the reflecting goniometer, placed an entirely new degree of accuracy within the reach of the crystallographer'; and further 'In the use of this instrument, no one was more laborious and successful than William Phillips . . . and Mr [H. J.] Brooke, a crystallographer of the same exact and careful school . . .' (Whewell, 1857).

In fact William Phillips, as early as 1814, published an elaborate paper on the different modifications in the crystalline forms of cassiterite based on measurements made with the new goniometer (Phillips, 1814). Two years later he published the first edition of his *Elementary introduction to mineralogy*; a second edition appeared in 1819, and a third in 1823.

In his third edition he was able to include measurements of the interfacial angles of crystals of a great many minerals illustrated by figures 'engraved on wood by W. Hughes', and for most species he endeavoured to give the primary form, usually with a figure. 'The letters on each plane of the larger figures have been so placed according to the system of notation adopted in the '*Familiar Introduction* . . .' by H. J. Brooke' (see below, p. 65).

In the 'Advertisement' to the third edition he gives his appreciation of the accuracy obtainable with Wollaston's goniometer. 'Experience', he wrote, 'leads to the conclusion that the limit of error is considerably within one degree,—that it rarely exceeds 40 minutes, and that it is frequently confined to a minute or two . . . but where those (the interfacial angles) of the primary form have been obtained from planes produced by cleavage . . . they may be considered as approximating to the truth much more nearly than when taken by means of natural planes.'

H. J. Brooke, the second of the two so favourably mentioned by Whewell as having contributed so many measurements of crystals in the early days of the 'reflective goniometer', was responsible for many papers on various minerals between 1820 and the year of his death, 1857. Many of these deal with crystalline form and include a series of twelve papers 'On the crystalline forms of artificial salts' in Thomson's *Annals of Philosophy* for 1823 and 1824. Two later papers are on crystallization, and on isomorphism (Brooke, 1825, 1831). In the latter he makes some comments as to the degree to which measured interfacial angles bear out the claims made by Mitscherlich for isomorphous groups.

He also published in 1823 *A familiar introduction to crystallography*, dedicated to Wollaston. In this he used a system of letters and subscript figures as indices of crystal forms. He used the capital letters P, M, T, for the *primit*ive, or primary forms, and other letters in small type for secondary and other faces. The system may have been suggested to him by the method used by Bournon in his treatise on the crystal forms of calcite and aragonite (see p. 60), wherein he allotted numbers to each of the forms he found.

In his calculations of the laws of decrement producing secondary planes, Brooke showed how this could be done using the formulae of spherical trigonometry which, as Whewell remarked in his 1832 report, 'has in great measure been followed by others' (Whewell, 1833).

Brooke also wrote a treatise on crystallography and an article on mineralogy in the *Encyclopaedia Metropolitana* (1845a, b). In the former he reduced the number of primary forms from the sixteen in his *Familiar introduction* (1823) to six, corresponding to the six crystal systems.

Brooke was co-editor with W. H. Miller of a new edition of Phillips in 1852. Evidently anxious to make it clear that Professor Miller had contributed the major share to the arrangement and re-writing of the book, Brooke wrote a postscript to the preface in which he states that his share in the work consisted of 'such information relating to the minerals described as a long acquaintance with them enabled me to afford, and in having supplied such specimens and crystals as it appeared desirable again to examine and measure'. Brooke's collection was presented to the University of Cambridge in 1857 by his son. It was kept in its own cabinet in accordance with his son's wishes. Also in the Cambridge collection are some of W. H. Wollaston's mineral specimens. They formed part of Henry Warburton's collection presented by H. W. Elphinstone in 1858.

William Whewell who, as mentioned above (p. 64), succeeded Henslow as Professor of Mineralogy at Cambridge, wrote all his important papers on crystallography before his formal appointment to the professorship. In 1822 he read a short paper explaining the interpenetrant twin cubic crystals of fluorite, in the course of which he offered some pertinent criticism of Haüy's theory of integrant molecules (Whewell, 1822). His three next papers, 1825–1827, all deal with a system of notation for crystal faces and with calculations of interfacial angles.

In the *Philosophical Transactions* for 1825 he gave 'A general method of calculating the angles made by any planes of crystals, and the laws according to which they are formed' (Whewell, 1825a). An abstract of the paper was published in the *Edinburgh Journal of Science* and in this Whewell added 'formulae for calculating the angles made by any secondary faces of a crystal when the law of its derivation from the primary is known' (Whewell, 1825b). Whewell, starting from Haüy's theory and his method of developing secondary faces by decrements of the 'integrant molecules' parallel to two or more of the edges of the primary form, set out to express such secondary planes by algebraic equations. Taking as origin the angle of a primary form and the three edges of, for example, a rhomboid as axes XYZ he showed that 'the equation of a plane arising from the decrements will be such that the coefficients of the three co-ordinates in it (when reduced to its simplest form) will be the reciprocals of the numbers of the molecules subtracted on the edges to which they correspond; or put in another way: if the three edges of a rhomboid are taken as axes, X, Y, Z, then any face P Q R making intercepts $\frac{x}{h}, \frac{y}{k}, \frac{z}{l}$ has for its indices $\frac{1}{h}, \frac{1}{k}, \frac{1}{l}$, or ($p$; q; r), written with semi-colons between them and in parentheses'.

There were two more papers read before the Cambridge Philosophical Society (Whewell, 1827a, b). In these Whewell sought to explain and to improve upon the system of notation proposed by Mohs (1825) and by Naumann (1826), and he proposed a modification of Mohs' notation doing away with the + sign which had encumbered it. He gave a 'specimen of the use of notation in the analysis of crystalline forms taking as an example crystals belonging to the rhombohedral system' (Whewell, 1827c). He also, very briefly, explained his method in his *History of the inductive sciences* (1857 : 184–185).

Whewell resigned the professorship in 1832. In the same year he presented a report to the British Association on 'The recent progress and present state of mineralogy', which was published in 1833. In this he was very critical of British contributions to mineralogy but he knew that he had in W. H. Miller a successor for the Chair of Mineralogy who would establish in Cambridge the crystallography he had begun to develop.

William Hallows (or Hallowes) Miller, who succeeded Whewell, was only seven years his junior. Like Whewell he was a mathematician; he had been fifth Wrangler in 1826. He wrote books on hydrostatics and on the differential calculus and was best known for his extremely accurate work in the preparation of new standards for the pound weight.

Miller had also written papers on the position of the axes of optical elasticity in crystals belonging to the oblique-prismatic system (Miller, 1835), and on the unequal expansion of minerals in different directions by heat (Miller, 1837). His first paper relating to crystallography on the forms of ammonium bicarbonate was published in 1829, the year after Whewell became professor. After this he wrote only some 24 papers on crystallography, some of which are mentioned below, but his very important early work was *A treatise on crystallography* completed in 1838 and published in 1839. In this he announced his method of describing the position of any face with reference to three axes parallel to possible edges of the crystal by three numerals, rational whole numbers, which are, in the words of Nevil Story-Maskelyne, 'the denominations of three fractions with unity for their numerator and in the ratio of the multiples of the parameters' (Maskelyne, 1880).

Miller explained in the preface to his *Treatise* that he took the idea for the Millerian indices, as they are always known, from Whewell's paper (1825a), referred to above (p. 65) and also that he owed to Neumann (1823) the method by which crystal faces are indicated by the points in which radii drawn normal to the faces meet the surface of a circumscribing sphere. In this *Treatise*, making use of the methods of spherical trigonometry, he developed a great many formulae for the calculation of interfacial angles, face symbols and zone symbols, all adapted for the use of logarithms.

Miller's next great work was the 1852 edition of Phillips' *Mineralogy* which he wrote with Brooke as described above (p. 65). The full title of the book, *An elementary introduction to mineralogy*, was now somewhat misleading. It was a new book and far from 'elementary', it contained a vast number of results of crystal measurements by Miller and Brooke. In it Miller further developed his system of indices and methods of calculation and established the fundamental formulae in the general case and went on to demonstrate the simplified formulae applicable to crystals in his six systems of symmetry.

The descriptive mineralogical parts of the book recorded the principal localities at which each mineral had been found, provided some chemical analyses, gave tables of measured angles, recorded the fundamental angles (but not parameters), and gave lists of forms identified, illustrated by figures and by stereographic projections. The book with index ran to 697 pages with 647 figures. Story-Maskelyne described it as 'a monument to Miller's name. It will not be superseded and will always be referred to' (Maskelyne, 1880).

After the publication of this book Miller wrote several important papers on crystallography. One was his first statement 'On the anharmonic ratio of radii normal to four faces of a crystal in one zone' (Miller, 1857a). A second paper was a development of this: 'An improved method of finding the position of any face in crystals belonging to the anorthic system'. It uses 'the anharmonic ratio of the axes of four *zones* having a face in common' (Miller, 1858).

These and two later papers on the gnomonic and stereographic projections, published in his Crystallographic Notices in the *Philosophical Magazine* between 1857 and 1860, were incorporated in Miller's last book, *A tract on crystallography*, published in 1863. This, in Miller's own words, 'contains an investigation of the general geometrical properties of the systems of planes by which crystals are bounded, and of the formulae for calculating their dihedral angles, indices, and elements, given without demonstration in the last, 1852, edition of Phillips' *Mineralogy*; or of equivalent expressions in more convenient shape'. It was in fact a supplement to 'Brooke & Miller'. The *Tract* also included two chapters on geometrical and analytical investigations of a system of planes suggested to Miller by a paper by C. Q. Sella in 1856 on which Miller had already published a short paper in 1857 (Miller, 1857b).

Miller died in Cambridge in 1880 at the age of eighty. He had held the professorship for 48 years. There were many tributes to the man and to his work; several of these have been referred to, and quoted from, by A. J. Berry (1960) in his paper to which I have so often referred and from which I have derived so much information. Notable among these is one by T. G. Bonney in the *St John's College Magazine* (Bonney, 1880), and one in *Nature* by Story-Maskelyne who wrote: 'He placed the keystone in the arch of the science of crystallography. Future development of that science will follow on the lines laid down by Miller' (Maskelyne, 1880), a prophecy which has been abundantly fulfilled.

At Oxford, Maskelyne had been appointed Professor of Mineralogy in 1861 (see p. 64). He published little on crystallography at this time but preferred to concentrate on his teaching. However, he had in hand a book, parts of which formed the basis of his lectures on crystallography in the 1860s and, as Maskelyne states in his preface, was indeed in print. Unfortunately, it was not published until 1895 and then only as a result of persuasion and assistance from Lazarus Fletcher and Henry Miers, both pupils of his and colleagues at the British Museum (Natural History) (Maskelyne, 1895). Even as late as 1895 it seems to have been the first text-book in English to deal in detail with the subject since Miller. The chapters on crystal symmetry received high praise from A. E. H. Tutton in his review of the book (Tutton, 1895), but he criticized Maskelyne for setting his axes with OX to the right of the origin and OY to the front instead of making OX the front and OY to the right, which was the orientation used by P. Groth in, for instance, his *Physikalische Krystallographie* (1876), which continental crystallographers followed, and which Lewis adopted in his *Treatise* in 1899. However, it is only fair to Maskelyne to remark that when he actually wrote parts of his book and had had it set up in type he was following the orientation used by Miller whose last book, the *Tract*, was published probably about the time Maskelyne was writing.

Tutton describes as almost prophetic a passage which Maskelyne wrote when considering the ultimate significance of symmetry (*op. cit.*, p. 171). Tutton quotes from the passage the most important sentence, but it seems worthwhile to reproduce the whole passage here: '. . . the whole treatment of crystallographic symmetry on the assumption of planes and axes of symmetry, actual or potential, represents a geometrical abstraction; an abstraction that needs for its development and due expansion a complete science of position applied to the molecular mass-centres, competent to embrace not merely the relative distribution *inter se* – the *intermolecular* distribution – of the chemical molecules constituting the crystallised substance, but also the *intromolecular* arrangement of the atoms, or molecules of secondary order, whereof the molecules of the substance are themselves composed. Then the true significance of the ideal planes and axes of symmetry will be understood; and they will assuredly retain a place in the explanation of crystalline symmetry, since they rise into recognition directly from the fundamental principle of rationality of indices and are controlled by its consequences.'

The classification of crystal forms into the six (or seven) systems of symmetry now in use by geometrical crystallographers was developed from the early ideas of Romé de l'Isle and Haüy mainly by Mohs and Weiss and later by Naumann in Germany and Austria, and by Michel Lévy in France. We cannot claim any considerable contribution to this classification by British mineralogists in these early days.

At first Mohs had grouped all crystal forms in four systems: Cubic (or Tesseral of Whewell), Pyramidal (Tetragonal), Rhombohedral, and Prismatic (Rhombic), considering as hemihedral those forms with half the number of faces of the holohedral forms. These he later brought into two more Systems, Monoclinic and Triclinic. These six systems were those adopted in 'Brooke & Miller' (1852) and only slightly modified by later authors. W. J. Lewis in Cambridge and Alfred J. Moses in Columbia University (both writing in 1899) divided the Rhombohedral System into two, Rhombohedral and Hexagonal; but E. S. Dana (1892) had adhered to the single system naming it Hexagonal, and H. A. Miers (1902) had the same six systems but preferred the name *Cubic* to the *Isometric* adopted by American authors.

After this short digression on the names of the crystal systems one must return to the early years of the nineteenth century to record something of the work of Sir David Brewster, whose discoveries of the optical properties of crystals established the correlation of these properties with the symmetry of the crystals. His work on these phenomena commenced about 1815 and some of the most important results were brought together in a paper read before the Royal Society in January 1818 (Brewster, 1818). In this paper he showed that whereas minerals and salts crystallizing in the Hexagonal and Tetragonal systems had a single optic axis parallel in direction to the principal axis of the crystal, those crystallizing in the Prismatic, Oblique, and Anorthic Systems possessed two optic axes the positions of which he described.

Without any of the conoscopes or polarizing microscopes later available, but using plates of glass as polarizer and analyser, and a candle-flame or the sky as a light source, he described most of the phenomena now familiar in our text-books on crystal optics. He observed and described the coloured rings and the black cross shown by uniaxial crystals, the lemniscates and brushes of biaxial ones; the properties displayed by sector twins of amethyst, aragonite, and analcime; and he wrote on the value of all this in the determination of mineral species: an almost endless list of observations and all new (Brewster, 1834). All these and more were briefly recorded by Whewell in his report to the British Association already referred to (Whewell, 1833), and in the same report he summarized Sir John Herschel's demonstration of the dispersion of the optic axes, the rotatory polarization of light, and the correlation of the direction of rotation of the plane of polarization with right- and left-handedness in crystals (Whewell, 1833, 1857).

These observations of Brewster's, and of Herschel's must have had an effect on mineralogists comparable to that of von Laue's demonstration of the diffraction of X-rays by the crystal structure of zinc-blende in 1912. Herschel himself wrote of Brewster: 'The discovery of crystals which possess two axes of double refraction, . . ., is perhaps the greatest step which has been made in physical optics since the discovery of double refraction itself by Bartholinus. . . . It has opened new views on the structure of crystals, and will in all probability be the means of leading us to a more intimate knowledge of the nature and laws of those forces by which the ultimate particles of matter act on light and on each other' (Herschel, 1822 : 21).

To return now to the work of Nevil Story-Maskelyne, Professor of Mineralogy at Oxford; he had been appointed also Keeper of Minerals in the British Museum in 1857 (p. 64) but still carried on his teaching. Since the death of Charles Konig in 1851 there had been no one on the staff of the old Department of Natural History in the British Museum interested in minerals. With the appointment of Maskelyne the Department began to play a more important part in the progress of mineralogy and crystallography in London.

In spite of miserably poor conditions for testing minerals or measuring crystals Maskelyne succeeded in getting some reliable work done. He had to assist him with the Collection only Thomas Davies, then a complete novice of 21 but who, under Maskelyne, became a very competent mineralogist. Davies was appointed in 1858. In 1862 Maskelyne invited Viktor von Lang (later Professor of Physics in the University of Vienna) to join him as an 'Assistant'. Together they produced numerous 'Mineralogical Notes' in the *Philosophical Magazine* for 1863 and 1864. It was not until 1867 that Walter Flight joined the Department as a chemist and a laboratory was set up at no. 46 Great Russell Street because neither gas lights nor burners were allowed in the rooms of the British Museum.

In the *Philosophical Magazine* von Lang's papers were on the crystal forms of numerous minerals, while Maskelyne contributed one on connellite and one on columbite, all giving angular measurements and all well illustrated by crystal drawings. In his paper on connellite Maskelyne describes how he succeeded in measuring extremely small crystals by attaching to the Wollaston goniometer a small plano-convex lens in front of a small telescope 'which converts that telescope into a sort of microscope of low power', so introducing a device later used in horizontal goniometers by Fuess and others.

Maskelyne's other papers in this series of 'Notes' gave a general account of stony meteorites and descriptions of fifteen stones in the British Museum meteorite collection. He followed these with a paper read before the Royal Society in 1870 on the mineral constituents of meteorites. In connection with his work on meteorites, as early as 1861, he had a binocular microscope fitted with a polarizer and analyser and a rotating stage to assist him in the identification of minerals in thin sections of stony meteorites, the preparation of which he describes.

Maskelyne reclassified the great mineral collection following the crystallo-chemical system of Gustav Rose and replacing the system of Berzelius adopted by Konig in 1828. The rearrangement of the collection was made with the move of the Natural History Departments to the new Museum at South Kensington in mind but the actual move was not completed in Maskelyne's time. He had to give up his appointment at the Museum on the death of his father in 1879. In the last few years he had two of his old Oxford pupils as Assistants: W. J. Lewis, from 1875 to 1877, and Lazarus Fletcher, who was appointed in 1878 and succeeded to the Keepership in 1880 on Maskelyne's retirement.

This completes my account of early mineralogy in Great Britain, covering a period of 200 years and bringing us to the foundation of the Mineralogical Society of Great Britain and Ireland over a hundred years ago (Smith, 1976).

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John George Children, F.R.S. (1777-1852) of the British Museum. Mineralogist and reluctant Keeper of Zoology

A. E. Gunther

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This Essay has been written to Commemorate the 200th anniversary of the birth of John George Children on 18 May 1977

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Introduction

Much of what is known of the personal life of John George Children may be found in the biography of a dutiful daughter, Anna Atkins, written in the year after her father's death (Atkins, 1853). It is one of those mid-Victorian biographies which add so much to our understanding of the period. The author inherited something of her father's intelligence, and her work is more objective and better documented than many of its genre. A modern assessment would still find Children to be a man of character, cultured, highly intelligent, sociable and god-fearing. What it does for a scientist of unusual ability, even by present-day standards, is to place his life in perspective against his achievements in science and the institutions with which he was associated. If, because of the unusual circumstances of his career, he contributed relatively little to the science of zoology, he should be remembered for having the care of the natural history collections during the unsettled period following the Napoleonic wars. His eighteen years as Assistant and as Keeper included the transfer of the collections from the old British Museum in Montagu House to the new building on the same site, the first phase taking place in 1830, and the second in 1840. While he may have taken a larger place in the story of the British Museum than in the advance-

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ment of its science, his contribution to neither was negligible. In his chosen field of mineral chemistry, however, he was a pioneer, with a critical and creative mind which today would have brought him eminence as a research chemist in either the academic or the industrial fields.

The events in this essay which have been taken from Anna Atkins' *Biography* may be easily traced in its pages whether dates are given or not. But reference to two outstanding omissions in it must be made. The first is the failure to link the Royal Institution with Humphry Davy's and Children's experimental work; the second is the failure to give weight to the need for an enquiry by the Select Committee of the British Museum in 1835. This essay aims also to examine more closely the circumstances in which John Edward Gray (1800–1875) served his apprenticeship before succeeding Children as Keeper of the Zoological Collections in 1840.

About a tenth of the volume of Anna's biography comprises her grandfather's and father's verse which does much to reflect their attitude towards life. On the paternal and maternal sides of both families, it is worth noting, there were parsons, a fact that may account not only for the Christian response in both their lives, but also to the evangelicism which formed a part of John George's character (Anon. 1970; Woodgate & Woodgate, 1910 : 493).

Family and education

The Childrens (the name is a typically Kentish one, although brought, it is said, by a Duke of Gloucester from the Chiltern Hills) had been established in Kent at least since the 14th century. In the 17th century, an early George Children (1606–1670) went to Tonbridge School and to Oxford, later becoming Curate of Tonbridge,[1] and was the first member of the family to live at Ferox Hall. This was a large, handsome, brick and stone Georgian house with a fine staircase rising out of a two-storied hall, built by him nearly opposite the School on the site of the old tithe barn at least of Elizabethan age (Woodgate & Woodgate, 1910 : 279).[2] George Children (1742–1818), the father of John George Children (1777–1852), also went to Oxford and, he inherited Ferox Hall (Harrison, 1887).[3] Although called to the Bar in 1753 and becoming a Bencher of the Middle Temple and Treasurer (or head of the Society) in 1804 (Hart, 1933), he never practised, but instead became Justice of the Peace and Under-Sheriff of the Counties of Kent and Sussex. He was an example of the cultured 18th-century country gentleman, giving his time to the affairs of the town and to the upbringing of his son. However, he was interested in experimental science, being chiefly excited by the electrical discoveries of Volta. A wealthy man, he was also one of the proprietors of the Medway Navigation Company, a flourishing concern that during the 18th century brought increasing trade to Tonbridge. Feeling that the town needed the services of a bank to encourage its expansion, Children together with two friends established 'The Tonbridge Bank' with himself as senior partner, in 1792 (Woodgate & Woodgate, 1910 : 376). But being country gentlemen without financial expertise, their firm fell a victim to the recurrent financial crises of the Napoleonic Wars, an event that plays a significant part in this story.

John George Children was born at Ferox Hall on 18 May 1777. His mother died a few days later and the boy was brought up in the freedom of the estate by an indulgent father and by the family nurse to whom he gave a boy's warm affection. After attending Tonbridge School (1786–1790), John was sent at the age of 13 to a tutor at Cambridge (a Mr Maud), who was to prepare him for Eton. The only one of Mr Maud's reports to survive suggests unusual promise, in that the boy

> '. . . is far the best of those who read with him, and by the time he has fulfilled his year, he will be better qualified for his place at Eton than any boy I have ever sent there . . .'.
>
> (Atkins, 1853 : 10)

While at Cambridge, the boy's interest in science appears to have been awakened by his uncle, the Rev. J. T. Jordan.[4] His letters to his father at this time contain an element of precociousness:

> 'I think I may venture to say that I understand the Rule of Three, both direct and inverse, perfectly, as likewise everything else I have gone through.'
>
> (Atkins, 1853 : 13)

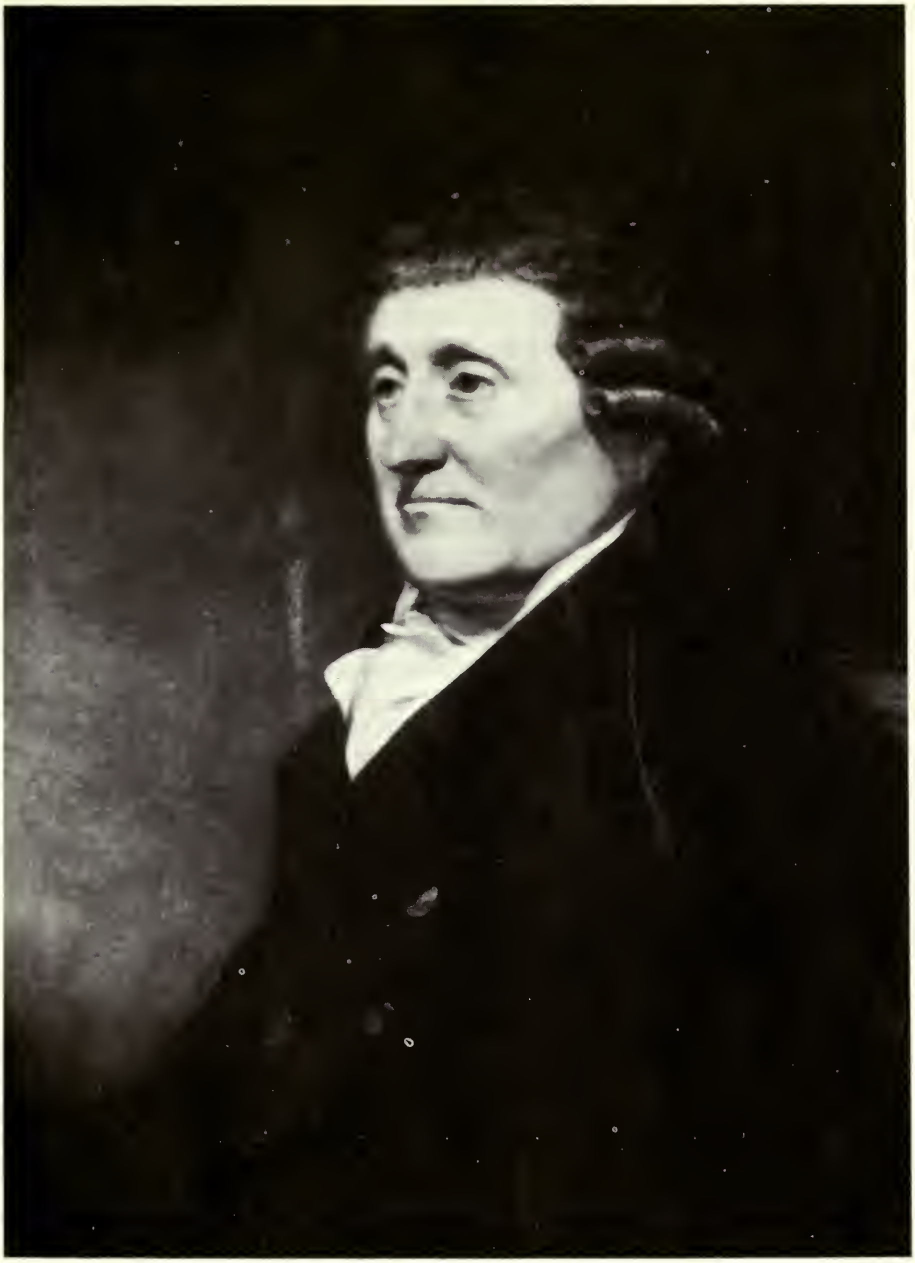

Fig. 1 George Children (1742–1818) of Ferox Hall, Tonbridge, Kent in 1806. Oil on canvass by A. J. Oliver R.A. (1774–1842). Donated to the National Portrait Gallery by Mr John Charles Children in 1977.

His years at Eton were active and happy, but his health, never robust, was not improved by the river climate. In 1795, at the age of 18, he passed into Cambridge as a Fellow Commoner of Queens' College, but preferring marriage to a university education, he did not proceed to a degree. Instead he courted a young lady, Hester Anna Holwell, daughter of a Lieut-Colonel Holwell whose father, Governor Holwell, had in 1756 been one of the survivors of the Black Hole of Calcutta. They were married in June 1798.

The Royal Institution, 1800

In March 1799 was founded a national institute, named the Royal Institution, which aimed at the 'promotion of science and the diffusion and extension of useful knowledge' and was destined to have a vital bearing on Children's life. In framing its constitution, Lord Romford, the founder, set up Committees of Managers and Visitors, and sought subscriptions from wealthy men with an interest in science. On Friday, 21 March 1800, at an Extraordinary Meeting of the Institution, George Children senior of Tunbridge (*sic*), Kent, was admitted as a 'Life Subscriber', and at a Meeting of the Managers on 7 April 1800, John George Children was also proposed by Sir Joseph Banks, one of the Managers, as a 'Life Subscriber' (Anon., (Royal Institution) 1800–1836; Archives of the Royal Institution, 28, 47). There is no record of Children senior having any further contact with the Royal Institution, nor of John George until his election as Visitor in 1826. But it is significant that the appointment of Humphry Davy (1778–1829) early in 1801 as lecturer in chemistry was followed on the last day of that year by a New Year display of fireworks of John's own manufacture at Ferox Hall (Atkins, 1853 : 37). The assumption could be that John attended Davy's lectures during that year. However, John's early scientific pursuits were interrupted when, after a protracted illness following the birth of a daughter, Anna (1799–1871), his wife died, after only 18 months of marriage. For solace John spent much of the next two years in travel, first to Portugal, then to Ireland, and in 1802 to the United States and Canada. There he received the Colonial style hospitality accorded to the son of a country squire, but his constitution again faltered during the passage on Lake Ontario from York to Kingston when he went down with a severe attack of 'lake fever', presumably malaria. Cutting short his visit, he returned to England in November with an odd miscellany of 'plants, a canoe, and among other things an eagle' (Woodgate & Woodgate, 1910 : 301).

Mineral chemistry at Ferox Hall, 1806

The year 1802 found the country in an unsettled state following the improvised peace of the Treaty of Amiens, and the counties were recruiting militia against the possibility of a French invasion. The West Kent Militia, which Children joined on his return from America, was a key force in the country's defensive system, fortified by contributions from the landed gentry including Children's father. A force of 6000 men was commanded by these gentlemen and their sons, among them Lord Camden (1759–1840) (Rigg, 1896):[5]

> 'Probably no mess-room contained a more gentlemanly set of men, not any better qualified for duty had they been called into active service.'
>
> (Atkins, 1853 : 59)

In 1805 a recurrence of fever forced John George to resign and it is possible that the realization that he could never serve his country in a time of crisis brought him, now approaching 30, to a more purposeful frame of mind than hitherto. Significantly, Anna Atkins implies in her biography that 1805–1806 was something of a turning point because, forced to leave the militia, her father

> '. . . now began to devote himself principally to science and mechanics, the great delight of his life, neither of which he ever ceased to pursue as opportunity permitted.'
>
> (Atkins, 1853 : 66)

When his father's neighbours heard after his wife's death that John was off to Lisbon, they gossiped in their letters that:

> 'John George Children is gone to Lisbon and means to proceed to Italy. If he never returns it will be no loss in my opinion.'
>
> (Woodgate & Woodgate, 1910 : 357)
>
> 'I suppose you have heard now all about John George; he will never come back again in a whole skin, in my opinion.' And later: 'John George, a little bird told me, is coming home.'
>
> (Woodgate & Woodgate, 1910 : 390–391)

The character of a young man of exceptional intelligence, greatly spoilt as a boy, may have been misjudged by his neighbours, but it required the shock of the loss of his wife, followed by having to leave his friends in the defence of the country, that led him to seek his real vocation in science.

Hence forward Children's main interest appears to have lain in the chemistry of minerals. In 1806, to acquire material for its study, he set out on a tour of the better known geological exposures of Wales and Cornwall. Starting from Oxford, where he presumably went to visit the Old Ashmolean Museum (Gunther, 1925 : 331), proceeded into central Wales – Shrewsbury, Ludlow, Much Wenlock – 'to hunt for dog's tooth spar in limestone rock'; thence he travelled down the Wye by boat on to Cheddar, and by Exeter into Cornwall, the *terra firma mineralogica*, and the main objective of the tour. The collection of rocks and minerals he returned with was the first and only collection his daughter records his having made (Atkins, 1853 : 66).

In view of his interests, it is surprising that Children had not joined the embryonic Geological Society, which came formally into being in 1807, since it was heavily biased towards the study of minerals (Woodward, 1907). One would also have expected some record of his attendance at the Royal Institution where Humphry Davy was lecturing on geology as well as on chemistry, and gathering together a collection of some 3000 mineral specimens. Virtually the next record is of Children's election, on 12 March 1807, to the Fellowship of the Royal Society. Whether there is any significance in the citation recommending him as 'likely to become a valuable member of the Society',[6] rather than one who had already made some major contribution to science, is open to question, but his sponsors did not include any who were to witness his experiments with the voltaic battery a year or so later. Two of Children's sponsors were titled. Lord Romney (Charles, Viscount Marsham) (1744–1811), F.R.S. (Anon., Burke, 1970), was M.P. for Maidstone and Kent as well as Lord Lieutenant of Kent, and was well known to Children senior. Charles Stanhope (1753–1816), the 3rd Earl, Viscount Mahon, was the troublesome, democratic politician, but also the brilliant scientist, a prolific inventor and F.R.S., who in 1779 contributed a paper on the *Principles of Electricity* to the Society, but is not mentioned in connection with Children's own work (*D.N.B.* **54** : 1). The others included Edward Rudge (1763–1846), F.R.S., a botanist and antiquary (*D.N.B.* **49** : 383), and Matthew Smith, F.R.S., a captain in the Royal Navy (Thompson, 1812). The remaining two, Edmund Antrobus, F.R.S., and Thomas Harrison, F.R.S., are lost to view.[6] Whereas, two years later, after the presentation of Children's first paper to the Society, there could have been ample grounds for recommending him for election, the bestowal of such an honour in advance suggests an element of patronage not uncommon in those days, albeit in his case justified in the event.

Mr Humphry Davy at Ferox Hall, 1808

In 1800 news arrived in England of Professor Volta's (1745–1827) discovery of the galvanatic pile, which by providing a source of 'electric fluid' offered an additional tool in chemical analysis. It was a discovery of the greatest importance to a practical chemist such as Humphry Davy at the Royal Institution, but the problem remained of how to build a battery large enough to give a high voltage. One should ask what were the relations between the Childrens and the Royal Institution, and possibly Davy, from 1800 until their known collaboration with Davy in 1808 in his experiments using the voltaic battery built by the Childrens. It is a strange omission from

Anna Atkins' life of her father that she makes no mention whatever of the Royal Institution, or of any connection her father or Davy may have had with it. It seems scarcely conceivable that the Childrens could have embarked on so complex and costly a technical venture as the building of a large voltaic battery without consulting an experimentalist of Davy's ability or even some of his colleagues who were working in the same field. Yet there is no evidence to suggest otherwise; indeed, there is no record of Davy's collaboration with Children until his first visit to Ferox Hall in 1808. If John George had attended Davy's lectures at any time in the previous seven years, Davy could well have been the inspiration not only of Children's interest in mineral chemistry but also for invoking electricity to aid him in his studies. Yet on this subject the Atkins biography, and other sources, including Children's obituaries, are silent.

In Atkins' biography, Humphry Davy is first mentioned in a paragraph on page 74 as '. . . that great chemist whose career from an early period Mr. C. [Children senior] had watched with great and sincere interest'. The page deals with events (undated, but in chronological order) of around 1808, and mentions the existence of the laboratory, the suggested date for which is *c.* 1806. It is suggested that the reason why Davy did not enter the biography earlier was the fear that John George's collaboration with him might detract from the importance of the latter's achievement.

The construction of a voltaic battery larger and more powerful than any previously built called for money and considerable technical knowledge, and these father and son are on record as having provided. Children senior

> '. . . retired from the active exercise of his business and gave his energy and money to aid his son in constructing new and large galvanatic batteries.'
>
> (*D.N.B.* **10** : 249)

A special building was required, and sometime after 1801, perhaps as late as 1806, a laboratory was built in the grounds of Ferox Hall, and it probably stood between the Hall and the Priory, a stone's throw down Bordyke (Hoole, 1970). In October 1808 Davy visited Ferox Hall for the first time and stayed for some days, afterwards writing enthusiastically of Children's 'magnificent experiments and apparatus', the results of which 'Banks, Cavendish and Wollaston desire to be published'. His letter also expressed feelings of unusual warmth, which led to a bond of friendship between the two men which lasted for the rest of their lives:

> '. . . the days I have passed in your society are some of the pleasantest of my life. I look forward with a warm hope to our next meeting.'
>
> (Davy, 5 Nov. 1808, BL. Add. MS. 38,625, f. 1)

Even if Davy and Children had known each other previously, the first days spent in joint activity created especially strong personal ties. The formal address of 'My dear Sir' gave way to 'My dear Friend' and to 'My dear Children', and so it remained.

As a result, on 24 November, Children's first paper was read to the Royal Society, being *An Account of some Experiments performed with a view to ascertain the most advantageous Method of constructing a Voltaic Apparatus for the purpose of Chemical Research* (Children, 1809, *Phil. Trans.* **99** : 32–38), and received, as had Davy's describing previous experiments, marked attention. The experiments were continued during 1809 and were observed by such notables as Cavendish, Herschel, Wollaston, Allen and Pepys. Davy wrote:

> 'I hope you will not suffer these beautiful and satisfactory experiments of the capacities of metals to remain still. Write me a letter as egoistical as I have given you. You are pledged to do good and noble things, and you must not disappoint the men of science of this country.'
>
> (Davy, 1809, BL. Add. MS. 38,625, f. 5)

The records of the Royal Society Club show that Children dined as Davy's guest on 22 September 1808, and having been proposed by Davy and seconded by Banks, became a member of the Club after the Anniversary Meeting of 29 June 1809 (Davy, 1808–1824, f. 5; Anon. (Royal Society), 1808–1809; Geikie, 1917).

The success of Children's experiments led Davy to construct a still larger voltaic battery at the Royal Institution. This was followed by an even larger model built by the Childrens at Ferox Hall and the biggest of its kind ever made:

> 'In 1813, George Children put in action the greatest galvanitic battery that has ever been constructed. . . .'
>
> (Anon., *Ann. Phil.* 1813, **2** : 147)[7]

Davy continued to visit Ferox Hall to participate in the experiments which found a record in his papers in the *Philosophical Transactions*, and the *Annals of Philosophy* or in Children's final paper to the Royal Society in 1815 (Children, 1815, *Phil. Trans. R. Soc.* **105** : 363–374) most of which were witnessed by one or other members of the Geological Society.[8]

These early experiments, in which an electric charge was directed onto various chemical or mineral substances, were not without danger, one such could have deprived Children of his sight (Children, Anon., 1808). In 1812 Davy's life was put at risk by the explosion of a 'new detonating compound' (nitrogen trichloride), which confined him to his room at Ferox Hall for several days with damage to an eye and to a finger. A letter warning Sir Joseph Banks of these dangers was read at the Royal Society's meeting on 5 November 1812 (*Phil. Trans. R. Soc.* Nov. 1812, **103** : 1–12). That Children's early experiments had more than passing value is clear from references made to them in standard works appearing twenty-five years later, notably in *Heat and Electricity* (Thompson, 1840, **2** (6) : 372) and *Manual of Chemistry* (Brande, 1841 : 299–300), as well as in the earlier *History of Galvanism* (Bostock, 1818 : 92–96, 99–101).

It was during this period of intense scientific endeavour, attended by success and recognition, that on 20 December 1809 Children married a second time; sadly, however, his wife Caroline Wise died in August of the following year.

Failure of the Tonbridge Bank, 1812

The growing instability of the Tonbridge Bank, first evident in 1807, its continued management by country gentlemen with little knowledge of finance but, it was said, with extravagant standards of living and entertaining, brought the bank finally to close its doors in 1812. In an attempt to maintain his position Children decided to put his knowledge of chemistry to commercial use and entered into a partnership, which was to include Humphry Davy, with a Mr James Burton, intended to establish a manufactory for gunpowder. The story of Davy's initial interest in the project, of his revising the recipe for gunpowder to yield a more effective explosive mixture, and of his decision, ultimately, not to participate in the venture, is recorded in his letters to Children between 1811 and 1813. The story was later described in detail elsewhere (Fullmer, 1964); the transaction, which ended in commercial failure, is not one that does Davy credit and would have broken a friendship of a less charitable man than Children.

In 1816 the Tonbridge Bank was declared insolvent, and George Children senior became bankrupt. At the age of 74, broken in health, he was placed under the care of Sir Everard Home (1756–1832) (*D.N.B.* **27** : 227) of the Royal College of Surgeons. Ferox Hall was sold and a house in Long Acre was lent to him by Charles Hatchett, F.R.S. (1765–1847), until health made a move to Chelsea, to escape from the smoke of London, desirable, and at 'Cook's Ground Cottage', the old gentleman died in August 1818. The tablet erected to his memory in the Parish Church of St Peter and St Paul, Tonbridge, is an eloquent and touching memorial to a cultured and great-hearted country squire (Anon. 1970).

A few weeks after his father's death, John George Children, accompanied by his daughter Anna and escorted by Samuel Forfeit Gray (1798–1872), John Edward Gray's brother, took a trip to the Continent and visited the site of the Battle of Waterloo. There, the party was taken to see the elm tree under which the Duke of Wellington had stood during part of the battle. When informed by the guide that the farmer owning the land was intending to fell the tree because tourists trampled his crops whilst seeking mementos, Children immediately made the farmer an offer to purchase the trunk and had it shipped to England (Atkins, 1853 : 193–197). To commemorate the event, Children engaged Chippendale the Younger (1749–1822) to make various items of furniture out of its timber. Three chairs were made: one, called the Wellington chair, was presented to King George IV (1820–1830), a collector of continental furniture. It stood for a time in the Guard Room at Windsor Castle and has since remained in the Royal Collections at St James Palace (Anon., 1967). The second, presented to the Duke of Wellington, was used by him when sitting for his portrait and is kept by the present Duke in his private apartments in the Wellington Museum, Apsley House, Hyde Park Corner. The third chair was in the possession of the Duke of Rutland at Belvoir Castle. Children also had a cabinet made for his mineral collection, which passed to his daughter, Anna, and is now in the room of the Keeper of Mineralogy at the British Museum (Natural History) (Anon., 1852).[9]

Children at Montagu House, 1816

The bankruptcy of his father brought Children to seek 'honourable employment'. Three years before, seeing the writing on the wall, he had approached Davy to enquire whether there could be an opening for him in the British Museum at Montagu House. On writing to a friend, Mr Payne Knight (1749–1824) (Edwards, 1870 : 401–412), an antiquary, collector and politician, and one of the Museum's Trustees, Davy learned that application should be made to the Archbishop of Canterbury, and, in the case of a scientist, the support should be sought of Sir Joseph Banks. He wrote to Children:

> 'I wish it were in my power to serve you more. If the election [of an assistant to Taylor Combe in Antiquities] had been in the Trustees in General I might have been of some use . . . .
>
> Be of good courage, for if the Museum should fail, you have always claims on the gratitude of men of science, and though there are few of them [as] liberal as Mr. Hatchett yet there are some who will not cease to exert themselves on your behalf.'
>
> (Davy, 1813 (?), 30 Aug., BL. Add. MS. 38,625, ff. 40–41)

When in 1816 the need for employment became urgent, Davy was again approached. In February he called twice on Sir Joseph Banks to find him in bed; he again wrote to Children:

> 'Be assured that if any place connected with science [opens up] no time should be lost in urging your claims. . . . Believe me you may trust to my zealous exertions and I hope to be able to persuade others of your friends to act whenever the opportunity shall occur.
>
> Sincerely Dear Children,
> very sincerely yours,
> H. Davy.'
>
> (Davy, 1816, 6 Feb., BL. Add. MS. 38,625, ff. 44–46)

Davy's next enquiry was made at the Society of Arts, of which he concluded that '. . . except in a scientific question my recommendation would have no weight and political patronage only belongs to political men' (Davy, 1816, 26 Feb., ibid. f. 47). Alternatively the professorship of chemistry of the Dublin Society was likely to fall vacant; but nothing came of that. In August he learned that the Trustees of the British Museum were looking for a print librarian, but required the applicant to be an artist (Davy, 1816, 23 Aug., ibid. f. 49). These further applications having failed it was thanks finally to the good offices of Lord Camden, a friend of the West Kent Militia days,[5] that Children was offered a post as Assistant Librarian in the Department of Antiquities at Montagu House whose Keeper was Taylor Combe (1774–1826) (Wroth, 1887, **11** : 429).[10] The date on which the Trustees accepted Children's Bond of Surety was 14 December 1816; he was to receive £30 a quarter and a further £112 for extra duties. Under-Librarians were expected to attend for six days a week, and to give six hours a day, 9–3 or 10–4. On three days a week four hours a day would go in conducting parties of visitors through the departments, the balance of the day going in routine work such as in display or in labelling. The other three days would go in 'extra duties' such as making catalogues, what we would call 'research' or approving the application of those who came to use the Reading Room. Since it was Children's habit to apply himself with assiduity to whatever he undertook, he offered the usual service on the three 'free' days of the week.[11] His knowledge of chemistry was put to immediate use in a novel field, in analysing the *Nature of the Pigment in the Hieroglyphics on the Sarcophagus from the Tomb of Psammis* (Children, 1821); this may have been the first of many subsequent times that analytical chemistry was used in the British Museum. Nevertheless, the final letter from Davy in the series quoted above, written sometime in 1817, found Children restless:

> 'You may be assured that whenever a favourable opportunity [of an opening in science] occurs I will not lose it; but I pray you do not adopt so despairing a tone. You have numerous friends, a fixed station in society, a comfortable income, more than many men of science can command and prospects of better things.'
>
> (Davy, 1817, undated, BL. Add. MS. 38,625 ff. 52–54)

In general, however, it seems that the five years in the Department of Antiquities were contented ones; when Children's future there was brought to a close it was much against his wishes. Meanwhile in 1819, Children married on 31 May for the third time; his new bride was a Mrs Eliza Towers, and they lived at Montagu Place, Russell Square, until 1821 when apartments became available at Montagu House.

Sir Humphry Davy as Trustee of the British Museum, 1820

In 1821, Sir Humphrey Davy again entered on Children's working life, on this occasion in his little known capacity as a Trustee of the British Museum. Davy had risen to prominence at the early age of 23 through his appointment in 1801 as the first Professor of Chemistry at the Royal Institution, founded two years earlier. He was elected to the Royal Society in 1803, succeeding Edward Whitaker Gray (1748–1806), Keeper of Natural History (Gunther, 1976), as one of the Secretaries of the Society. In 1820, on the death of Sir Joseph Banks, Sir Humphry, as he became in 1812, was elected President of the Royal Society, which, also brought him, *ex officio*, onto the British Museum's Board of Trustees as Banks' successor. On 9 December it was decided that:

> '. . . the names of Sir Henry Halford[12] (*D.N.B.*, **24** : 39) and Sir Humphry Davy be added to the Sub-Committee appointed to look after the present state of the specimens of Natural History in the Museum still remaining unpreserved.'
>
> (Trustees Minutes, C.2766, 9 Dec. 1820)

Davy's function was to exercise a general supervision of the Natural History branch, then under the Keeper, Charles König (1774–1851), in matters of money, purchases, sales of duplicates, etc. To Davy were also referred problems of a technical nature that came before the Trustees, among which was the defective heating system of the newly built Townley Gallery of marbles and antiquities.[13] He was asked also to suggest methods for preserving stuffed animals from further decay,[14] for which he designed a model show-case 'composed of permanent materials [which] shall be perfectly air tight'.[15] He was generous with gifts to the Museum, passing on specimens that came his way and, in return, occasionally taking samples of minerals for his experiments.[16]

As President of the Royal Society, Davy was able also to bring his authority to bear on problems arising between the two institutions. Not the least of his services were those he undertook towards the end of his life in representing the public in negotiations with Robert Brown (1773–1858), Banks' executor, for the immediate use of the Banksian Library and collections (Edwards, 1870 : 508; Miller, 1973 : 226). Davy was also responsible in 1826 for initiating the transfer from the Royal Society of the Sir William Jones' (1746–1794) (*D.N.B.* **30** : 174) collection of oriental MSS.,[17] which, although left to the Society, lay outside its competence, and came finally to the British Museum in exchange for duplicate publications which the Royal Society lacked.

For a man who devoted his life to advancing the experimental aspects of natural philosophy, it was natural that Davy should find the atmosphere of Montagu House somewhat static. Whether he expressed his feelings to his fellow Trustees is not on record but a year or two before his death he certainly delivered his opinion with some force. His brother's biography of Sir Humphry

(Davy, 1836, **2** : 342–344), published after his death and a few months before the sittings of the Select Committee of 1836, contained Davy's dictated disparagement which added to the ammunition used by the Museum's critics. In return, it gave Antonio Panizzi, then Assistant Librarian, the opportunity of saying what he thought of scientific Trustees, including Sir Joseph Banks, for their excessive interference (Parliamentary Papers, 1836, 4945, 7 June).

On his appointment as Keeper of the Department of Natural History and Modern Curiosities in 1813, Charles König, who was primarily a mineralogist, had been allocated an assistant in natural history, William Elford Leach (1790–1836), a young medical student from Edinburgh. Leach was to establish an international reputation both for the quality of his original work and for his translation of the works of the French naturalists working with the Baron Cuvier in Paris. In the spring of 1821 Leach was taken ill, and although given every facility for recovery by the Trustees, his illness, reputed to be venereal disease, had taken too strong a hold. After leaving for Italy in the autumn, he formally resigned from the Museum in March 1822. Leach's place in this account is important because he not only surpassed any of his predecessors in ability as a naturalist, but he left an example which both his successors, Children and Gray, were to follow. Furthermore, the impression he made on the Trustees may be judged by the generosity with which he was treated both in the matter of his remuneration and in the purchase of his collections after he had left their service.[18]

Children's transfer to Natural History, 1822

The problem of replacing Leach was less of the shortage of zoologists in the country as of the poor pay and working conditions in Montagu House, which were not those a man of independence could accept. Dr William Hooker (1785–1865), at that time aged 31, still almost as much a zoologist as a botanist, was said to have been invited to apply, but the principal contender was William Swainson (1789–1855), then working on his collections at Liverpool. Swainson had much to offer, having worked in Sicily and recently returned from Brazil, but to some he lacked culture; he knew no foreign language and had acquired a reputation for inaccuracy (Günther, 1900). Faced with the lack of suitable alternatives, the Trustees decided to transfer Children, who was after all a scientist, from the Department of Antiquities to that of Natural History.[19] It emerged that the prime mover in this was Sir Humphry Davy who, wishing to do his friend a good turn by bringing him back into the field of science, persuaded the Trustees that it was more important to have a man of wide culture acceptable to the Museum's circle than a rough-edged outsider. Children's version of the move was told to the Select Committee 15 years later:

> 'I do not consider myself anything like the first naturalist in the country. My appointment was not originally to the Natural History department, but I was removed (I believe by the act of the Trustees generally in committee) from the department of Antiquities to the Natural History. This was due at the suggestion of Sir Humphry Davy, a man whom, of all others, you would probably consider as the fittest person to be a Trustee of the British Museum. The transfer was effected, as I have said, at his suggestion, and almost without my being consulted on the subject, and it has proved very much to my disadvantage. It took place after Dr. Leach's illness prevented his remaining any longer at the British Museum; it was not made in consequence of any wish of my own.'
>
> (Select Committee, C.3070, 24 July 1835)

The disadvantage was that, since Taylor Combe died in 1826, Children would have succeeded him as Keeper of the Department of Antiquities. Nevertheless, Children remained unswervingly loyal to Humphry Davy, coming to his friend's defence whenever Davy's work was criticized as in the matter of the Safety Lamp (Children, 1816), or in that of the protection of ships' bottoms from corrosion with copper sheeting (Children, 1824).

Among naturalists, Children's appointment in 1823 as the new Assistant Keeper was the cause of comment. Swainson's principal supporter was a certain Dr Thomas Stewart Traill, M.D. (1781–1862) (*D.N.B.* **57** : 151), a young medical man from Edinburgh who had taken up a practice in Liverpool but was also making a name as an educationalist in the cause of science. He was given to writing and lecturing and had been one of the movers in the foundation of the Liverpool Literary and Philosophical Society and the Mechanical Institute. He had struck up a close friendship with Swainson and, angered at the appointment to the Department of Natural History of an Under-Librarian, as Assistant under the Keeper, Charles König, without any zoological qualifications, he wrote a well-informed and scathing attack on conditions within Montagu House and on its management, which appeared in the influential *Edinburgh Review* and, being unsigned, received more attention than it might otherwise have done (Traill, 1823).

> 'With the highest respect for the acquirements of his [Leach's] successor, we cannot approve his appointment to that department, in which he has certainly little previous experience, and which, we are told, he has even professed his entire ignorance. No talents, and no industry, without long previous study, and practical application, can qualify a man for the charge of the Zoological Collection in the British Museum. His duty is not (in the present state of things) to be confined to comparing the articles with a catalogue. . . .'
>
> (*Edinburgh Review*, May 1823, p. 392)

Traill even suggested that the failure to provide

> '. . . a permanent provision for an *extra* Librarian being the cause of the removal of Mr· Children, from the antiquarian to the zoological department. . . .'
>
> (*Edinburgh Review*, May 1823, p. 393)

Some time after these events, the Principal Librarian, Joseph Planta (1744–1827), was assured by König that Children, of whom he had a high opinion, had come to welcome the change (Smith, 1969 : 19); all things considered, however, this appears unlikely. Of those who had charge of the natural history (zoological) collections between 1765 (with the death of James Empson) and 1900, Children was the only one not to have entered the field of natural history through a medical training, and it does not look as if a detailed interest in animal life, except in its broader philosophical implications, would have occupied a major part of his analytical and literary mind. Nevertheless, when Charles König was asked by the Select Committee in 1835 whether there were 'any more eminent naturalists of the day officially connected with the British Museum', he replied 'Mr. Children's merits are very great. Mr. Children has done much for science. He is also well versed in several branches of Natural History', and 'I think he is a good zoologist.' (Parliamentary Papers, 1835 : 203).

Lamarck's *Genera of Shells*, 1824

During the five years Children had been at Montagu House, he would have learned much from Leach of the general international situation in natural history, particularly in Paris where Leach was in 1818. Entering the field of zoology at the age of 40 without it seems even a schoolboy's penchant for collecting animals, Children may have seen the advantages in following Leach's habit of translating the works of the French natural history masters as he himself had already done in the field of chemistry; in this way he would learn about a new subject.

The first task to which Children put his hand after his transfer was to continue the rearrangement of the shell collection which Leach, with the help of his student friend, Gray, had started, based on the new classification put forward by the French savant, M. le Chevalier Lamarck (1744–1829) (Leach, 1852; Lamarck, 1815–1822). The Linnean system was inadequate because it was not based on the living animal – the natural classification used for other living animals – but on the protective exoskeleton, the shell or test in which the occupant enclosed itself. A major reason at that time for the importance of shells was their increased use in geology for the correlation of strata. A sound anatomical classification for Recent shells, as a basis for ordering fossils, had not been available in Linnaeus's day.

Children was fortunate in that his appointment in March 1822 was followed by the completion of Lamarck's text on Mollusca in the following August; realizing its value, not only to scientists but to the many English amateur collectors as well, he set about writing an English version. Being himself one of the editors of the *Quarterly Journal of Science*, he was in a position to assure its immediate publication (Children, 1822–1824). Accordingly, Children's abstract of the sixth and seventh volumes of the *Histoire Naturelle des Animaux sans Vertebrés* (1819–1822) appeared in the *Journal* in instalments between October 1822 and January 1824. It is a work with which, not unjustly, Children's name has come to be closely associated. But there was more to it than a literal translation of Lamarck's system now available to English collectors. The large number of shells being collected from all over the world called for a revision of genera: an increase in their number, their more precise definition, and for their illustration, lacking in Lamarck's work. This, an introduction to Lamarck's system, is what Children's *Genera of Shells* provided, including some 250 wood-cuts of the Museum's type-specimens carried out by Children's daughter, Anna (Dance, 1966). That Children had in his work an eye to a wider public than would be attracted to a literal translation of the French is clear from his attempt to make it something of a companion for the average educated but unscientific collector. Many hundreds of notes adorn the pages; the etymology of Greek and Latin names are given with aids to understanding the mythological events from which they derived. Thus Argonaut is explained:

> 'From *argo*, the name of the ship which carried Jason from Thessaly to Colchis, and *nauta*, a sailor.'
>
> (p. 164)

If a name implied a function, that was described, and Lamarck's French was adapted to use by an English reader. From the scientific viewpoint, Children refers to the elder James Sowerby's (1757–1822) current work and took his help in resolving Lamarck's ambiguities whether in nomenclature or in explanation – that is, if they could be resolved. How wide a use was made of the *Genera of Shells* in subsequent decades is not at all clear. It provided the basis for the 1838 edition of the *Synopsis of the Contents of the British Museum*, signed by Children, but is not referred to in Gray's *Genera of Recent Mollusca* of 1847[20] (Kennard, Salisbury and Woodward, 1931). Today, copies of the *Genera of Shells* are rare; few could have been printed, and therefore Children's influence on the malacology of his day was even less than it might have been.

Children's bent for translating foreign works, seen in his approach to minerals as well as to insects, calls for some comment. There can be few members of the Museum's staff who over the years translated as much material as did Children, they being concerned rather to add foreign data to their own. Children, on the other hand, evidently translated solely for the pleasure derived by a man of culture from adding to a scientific text, since for much of his keepership he had some work of translation on hand. When did he undertake it? Perhaps in the long winter evenings after the Museum closed at 3 p.m.

Children appears to have been actively concerned with the shell collection up to 1829 when the Trustees were asked to provide an additional 20 table cases, of which 17 were approved.[21] However, his *Genera of Shells* remained his only published contribution in this field. In his *Miscellaneous Autobiographical MSS.* (Gunther, in press, f. 10), John Edward Gray tells how, in the summer of 1823, he called at Montagu House to identify some shells and, meeting Children for the first time, who found him to know something of the collection, was encouraged to spend his spare hours helping in the work of rearrangement. From then on any lack of descriptive work on Children's part was, in the words of Dr Guy L. Wilkins, 'amply rectified by his new assistant, J. E. Gray' (Wilkins, 1957). Thereafter Children turned his attention to insects.

Children as zoologist

Since there are no departmental records in zoology for the period under review, or indeed until 1835, the work of the Assistant Keeper and his staff must be learned from their publications. The appointment of J. E. Gray as a daily paid assistant in December 1824 relieved Children of much of the taxonomic and other details. In the 19 years of Children's service, however, only three zoological papers other than his work on shells appeared under his name. The first was the translation of a French paper by Augustus Odier *On the chemical composition of the corneaus parts of insects* (Children, 1825) which disproved the authors' conclusions that nitrogen was an element present only in vegetable and not in animal organisms. The second was the Appendix XXI to *Travels in Central Africa* (Clatterton & Denham, 1826). The third pointed out that the Esquimaux dog illustrated in St Hilaire and Cuvier's *L'Histoire Naturelle* (Children, 1827) was not what it purported to be; it had, in fact, a Newfoundland dog mother.

In each of these contributions Children's part calls for examination. His literary style is generally detectable but the accompanying appendices on Botany and Rocks in *Travels in Central Africa* were by Robert Brown and Charles König respectively and it would therefore hardly have been appropriate for the zoological appendix to be by his daily paid assistant, Gray, who was making mammals his study. Similarly in the case of the *Esquimaux dog*, criticism of the work of such eminent French naturalists should not rightly have come from a junior assistant. In *c.* 1830 Children's name appeared also on the title page of *Illustrations of Ornithology* (Jardine, & Selby, 1830) with those of a further half dozen collaborators, but apart from a reference to the Museum's collection, there appears to have been no need to give Children co-authorship.

In November 1826, Children was elected Chairman of the Zoological Club of the Linnean Society which, a year later, called for an anniversary address (Children, 1827; Atkins, 1853 : 239). The meeting was held in the Society's rooms in Soho Square, and Children took the occasion to define his status as a zoologist, confessing that he

> '... began the fascinating pursuit of zoological science too late in life to expect to make great proficiency in it. ... I yield to no man in point of ardent attachment to zoology and zeal for its success. Circumstances compelled me to abandon a darling pursuit .... I will not deny that the sacrifice was a painful one, and not made without considerable reluctance; but were I to begin life again, and had the option of devoting myself to chemistry or zoology ... I think I should prefer the latter as opening up a more extensive view, if possible of the works of nature ... to a deeper sense of adoration of the Power through whom we live, and move, and have our being.'

Much of the address provided a useful review of the year's work of British zoologists both at home and abroad, in phrases more felicitous than was usual at scientific meetings. But in contrast to his superior, Gray was producing a steady stream of some twenty papers a year and was, perhaps, so aware of his lead that at the end of a long *Monograph on the Cypaediae*, which included 14 pages of references, he thought it appropriate to refer to his chief's qualities thus:

> 'I take the opportunity of dedicating this curious species to my excellent friend, J. G. Children Esq. whose extensive acquirements and zeal in science need not my feeble praise.'
> (*Zool. Jn.* **1–3**, 1824–1828)

In spite of Children's lack of contributions to zoological literature he gave much to others, and what he did for John James Audubon (1785–1851), the ornithologist, was typical. In May 1827 Audubon arrived on his first visit to London with the original folios of his work on the *Birds of America*, and within a month had been taken to the Linnean Society and to the Royal Society's Club. It was also on Children's initiative that the drawings were shown to the king, William IV, and so received royal patronage. Discussions led to the transfer of work on the plates from Lizars in Edinburgh to Robert Havell in London at an improved quality and price; to restricting the text to 'nothing more except the biographies of my birds' to save time, and before Audubon left for the States in April 1829 he had 'given the agency of my work to my excellent friend Children of the British Museum who kindly offered to see to it during my absence' – of two years (Audubon & Coues, 1898, **1** : 252–258, 276, 342). It was also Children, with Lord Stanley (1775–1851) (*D.N.B.* **54** : 66), who sponsored Audubon's election to the Royal Society and gave him the news immediately on his return to England in April 1831 (Herrick, 1938, **1** : 437).

In 1829, following his return to the States Audubon 'sent many bird skins, insects and live specimens to the British Museum and to the British Zoological Gardens' (Herrick, 1938, **1** : 420). But it was an unfortunate accident that the bird which Audubon named after his friend, *Sylvia Childreni*, proved to be a young of the species *Sylvia Æstiva* (Atkins, 1853 : 239).

In 1823 Children was called in to help establish the *Zoological Journal*, the first number of which appeared in March 1824 and which was 'conducted' until 1826 by Thomas Bell (1792–1880), James de Carle Sowerby (1757–1822) and himself. From 1827 the *Journal* was edited by N. A. Vigors (1785–1840), the first secretary of the Zoological Society, with the 'cooperation' of nine others including Children. But the journal Children preferred was the *Annals of Philosophy, a Magazine of Chemistry, Mineralogy, Mechanics, Natural History, Agriculture and the Arts*, first issued in 1813. In view of his earlier work, this preference was hardly surprising, since the *Annals* had been the first to bring to the public news of the Ferox Hall experiments. From the start of the New Series in 1821, Children is believed to have assisted R. Phillips and E. W. Brayley in the editorship (Atkins, 1853 : 208–211).

One gathers the impression that, by 1821, after five years as an Assistant Librarian in the Department of Antiquities Children found the call of chemistry too strong to resist, and he may have been stimulated by his new colleagues on the *Annals*. A year before his transfer to natural history he returned in his spare time, as his daughter records, to practical mineral chemistry. His analysis of the Egyptian pigment already mentioned was, after all, of interest to the Department of Antiquities, but his translation of Jean Rey's of Bazas (1582/3–1645) (Children, 1821; Partington, 1961, **2** : 632) essay on the *Calcination of Metals* of 1630, occupying some 50 pages of the *Quarterly Journal of Science*, could scarcely be said to be. On the other hand, his translation of the latest edition of volume 4 of L. J. Thenard's *Traité de Chemie Elémentaire* (Children, 1821) as a version for the use of a contemporary public, subtitled as 'comprehending the latest discoveries and improvements in this branch of science', served as a preparation for the work he was about to do. Indeed, in the next 5 years (1821–1825) Children contributed no less than a dozen papers and notes on mineral chemistry to the *Annals of Philosophy*, so adding considerably to his earlier reputation. With the blow-pipe he worked on the newly discovered elements, cadmium and diaspore, examined the minerals baryto-calcite, babingtonite, torrelite, brochantite and roselite; he discovered selenium in Anglesey pyrites and silica in sponges (Partington, 1962, **3** : 715–716). It was all this that inspired Henry James Brooke, F.R.S. (1771–1857) (*D.N.B.* **6** : 427), the mineralogist, to name a new mineral Childrenite:

> 'Mr. Brooke has lately described two new mineral bodies; to the first he has given the name of *Childrenite*, on account of the attention among other inducements, which Mr. Children has shown to mineralogical chemistry. . . .'
>
> (*Annals of Philosophy*, **7** : 316, April 1824, Scientific Intelligence, New Minerals)

For much of his life, Children had no need to turn his chemical expertise to commercial ends' but two occasions in the 1820s demonstrated the high opinion others held of his competence· On the first he was partly moved by the ethics of the case, whilst the second was a response to a challenge that came his way. In 1820, he was asked to act as consultant in a notable legal case between a firm of sugar refiners, Messrs Severn, King & Co., and a group of insurance companies. He joined six well-known chemists and others to dispute the evidence of an eminent chemist, Samuel Parkes (1761–1825) (*D.N.B.* **43** : 307) who was acting apparently unethically on behalf of Messrs Severn, King & Co. (Children, 1821). The second instance of Children's involvement with commercial interests came in 1823–1824 when, as a result of silver speculation in South America, the mining concerns were seeking a process for extracting the silver from its ores without the expensive use of mercury which had to be imported from Spain. In his spare time from his Museum duties Children evolved a suitable process, the sale of which helped to restore his depleted finances (Atkins, 1953 : 233–237).

These problems continued to engage him until about 1826, but he published nothing more on the subject. Instead there appeared in the *Annals of Philosophy* an essay based on the atomic theory hypothesis being put forward in France by the Swede J. J. Berzelius (1779–1848), and the Frenchman F. Beudant (1787–1850) (Children, 1825).

In July 1826, after four years in the Natural History Department, Children applied to the Trustees on the grounds of ill health for two months' absence for a tour of the Continent, which was to take him down the Rhine into Switzerland and Italy.[22] But at Schaffenhausen, on the Swiss frontier, he was taken grievously ill and had to abandon his journey. After several weeks' rest he 'bought an easy carriage' in the charge of an experienced courier – for French inns did not provide the comforts to which an English gentleman was accustomed – and took the road to Paris. Here he planned to call on Baron Cuvier and to visit the *Muséum d'Histoire Naturelle*, of which he would have heard much from Leach, Owen and others. In Paris, however, he was too indisposed to carry out any but the scientific part of his programme and the only social invitation he accepted was an evening with Cuvier who had previously shown him, together with J. E. Gray who had happened to be in Paris, around the museum (Atkins, 1853 : 235). On his return a period of convalescence overran his grant of leave but, since it had been occasioned by ill-health, the Trustees refrained from deducting any sum from his 'extra allowance'.[23]

Children had never been constitutionally robust, but from the age of about 45 there is increasing mention in his biography (Atkins, 1583 : 234) of uncertain health, but the breakdown on the continental trip was the first occasion on which he had been completely incapacitated for any length of time.[24] The strain on Children's nervous energy from the extra-mural duties which he undertook is evident from letters to J. W. Lubbock, his fellow Secretary at the Royal Society:

> 'I have been obliged to give up for a while every sort of exertion in the hope of recovery the tone of my nerves, which, whether from bilious derangement or whatever other cause seems suddenly to have given way. I hope rest and quiet will restore them but they are not right yet.'
> (Letter: Children to Lubbock, 22 July 1832. Royal Society, LUB.C.134)

But the trouble persisted for at least another month.

From the start of his work at Montagu House Children had found it necessary to live outside the polluted air of central London; shortly after 1821, although granted the use of Leach's apartments, he rented a house at Hampstead in 1823.[25] Thereafter, in summer, he maintained various *pieds à terre* outside Bloomsbury; if not at Hampstead he lived at Burford Bridge, near Dorking (1831), Norwood (1832), off Regent's Park (1833), at Wimbledon (1835), Mill Hill, near Hendon (1837), or at Blackheath (1838).

At the Museum there was more than enough to occupy a Keeper's time. If the structure of Montagu House made it impossible to refute all the criticism levelled against the Museum at the time of Children's appointment, considerable improvements had been made in the displays, as for example the shells; whilst the 'lists', as the early catalogues were known, were providing some basis for classification and arrangement. Nevertheless, it still had to be reported to the Trustees, in 1826, that 'stuffed animals still stood on the tops of the glass cases in Room 8' (Zoology) before sanction was given to enclose them.[26] There was still no Classed Catalogue of the department's books and, to illustrate the close watch kept by the Trustees on what went on, Children found it necessary to ask their permission to use two of his three spare days each week (days on which he had no peripatetic duties) to compile such a catalogue. This was despite the fact that the Trustees in 1827, and in the interest of a Classed Catalogue for the Museum as a whole, had requested each Keeper to prepare one such for his department; the *Classification of Zoological Works* which Children and Gray proposed, written (in Children's hand ?) in Latin on four quarto cartridge paper sheets with Gray's handwritten annotations in red ink, is preserved in B.M. MSS. 1835–1853, **45** : ff. 3–6.

In November 1826, in spite of his breakdown that summer, Children consented with some misgiving to become one of the Secretaries of the Royal Society, replacing William Thomas Brande (1788–1866), who had succeeded Sir Humphry Davy at the Royal Institution some years before. It seems likely that pressure to accept this appointment came from Sir Humphry himself, still President of the Society, and who, about to leave for Italy on the grounds of health, wished to have a friend at the seat of power. He died on his return in Geneva in May 1829. But the accumulation of duties at the Museum, the Zoological Club and the Royal Society proved too much for Children's health, and he gave up the Society's secretaryship at the first opportunity, in November 1827.

In 1826, Children after a long interval was again involved with the Royal Institution by being elected a Visitor (Anon., 1800–1836). In 1828 he received a unique honour in the award of the first John Fuller[27] Medal (Anon., 1800–1836). The founder's intention was that the medal should be awarded every other year for major discoveries in chemistry, but on the first occasion, 21 April 1828, Mr Fuller decided to present Gold Medals himself to the following members:

> 'Sir Humphry Davy, Bart.
> Dr. Wollaston
> Chas. Hatchett Esq.
> William Thos. Brande Esq.
> John George Children Esq.
> John Frederick Daniell Esq.
> Michael Faraday Esq.'

(As listed in Minutes of Managers Meeting, p. 196)

It was thus that Children's work at two periods of his life found recognition in the company of the great natural philosophers of the day: in 1806–1816 at Ferox Hall in the development of the voltaic battery, and in 1821–1825 at the British Museum in the pursuit of mineral chemistry, leading, happily in his own interest, to a new method of extracting silver from ores without amalgamation.

In 1830, and again in 1836, Children was appointed a Manager of the Royal Institution and served on the Committee for the regulation of the Friday evening lectures; however, he did not attend the meetings regularly and gave the Institute little of his time.

Children is recorded as having suggested in 1828 that a commemorative dinner be held on the bi-centenary of the birth of John Ray (1628–1705); it would not be surprising, however, if the idea came instead from Ray's possibly collateral descendant, John Edward Gray. On 29 November

> '... a public dinner at Freemasons' Hall was attended by about 130 of the most distinguished cultivators and patrons of Science, including several of the officers of the learned societies [including John Gray] and the Professors of Oxford, Cambridge and London.'
>
> (Anon., 1828)

Children was not amongst the eminent speakers, but his health 'was given with hearty approbation'.

Entomology and the Entomological Society, 1830

On the completion of his work on shells, Children appears to have turned his attention to insects. What initiated this interest is not clear; it may have derived from his father, perhaps as a hobby of the prosperous Ferox Hall days, since a family in that position would have had no difficulty in building up a sizeable collection. An obituary asserts that Children

> '... devoted a considerable portion of his time to the study of entomology, and formed a very large private collection of insects [put at 37 000], as well as one of the most complete entomological libraries in Europe.'
>
> (Westwood, 1852)

Children's first contribution to entomology seems to have emerged suddenly in 1828 with a condensed translation of Ochsenheimer's *Genera* (Children, 1828–1830) stimulated by the inadequacy of the *Entomologists Useful Companion* (Samouelle, 1819). Thus it might appear that, as with the *Genera of Shells*, Children used a contemporary standard work to provide himself with up-to-date knowledge on a subject, but his approach, as on the previous occasion, was that of a man of culture with a knowledge of the work of English entomologists, principally Stephens, Leach and Curtis. The first section of the *Abstract* appeared in the *Philosophical Magazine and Annals* in July 1828, and continued through another 14 numbers into the volume for July–December 1830. Then, when another Ochsenheimer volume failed to appear, the series came to an abrupt end. The translation, comprising 150 pages together with innumerable notes and 'Observations', some of considerable length, was no small achievement for a man in charge of a department currently moving into a new building, who was never strong in health. The work was followed in the same year by the last of his abridged translations, of Fabricius' *Systema Glossatorum* (Children, 1830). These works of translation by the Keeper of the national collections, together with the readiness with which he allowed others access to his library, marked him if not as the first entomologist in the country then at least as the logical focus for the founding of an Entomological Society. A preliminary meeting of the new association is believed to have been held in his apartments in the Museum on 3 May 1833 (Neave & Griffin, 1933). At this time a resolution was passed to form a Committee, which in turn called the First General Meeting of the Society on 22 May at the Thatched House, St James Street; J. F. Stephens (1792–1852) took the Chair and a Council was appointed. Children was elected as the Society's first President and as such addressed the first Anniversary Meeting on 26 January 1835. This address, adjuring the members of the Society to do their duty by their science, and, in a reference to the unity of nature reflecting the mind of the Creator, bearing Children's personal stamp of ethics, sought also to mend the differences between those within and without the Society (Neave & Griffin, 1933 : 86), namely, whether the Society's transactions should be exclusively devoted to entomology or not. Children contributed an Introduction to the first volume of the Society's *Transactions*; he also served on the Council from 1837 to 1838 and as Vice-President in 1838.

Whether Children's interest in the state of the collections and in the work of his insect specialist, Samouelle, was on the same level as his concern with his own rather peripheral activities described above remains in doubt because the deficiencies of both were brought forcefully to his attention by the enquiries of the Select Committee in 1836.

His own single practical contribution was the identification of some two dozen insect species brought by Capt. George Back from an expedition to the Arctic in 1833–1835 (Back, 1836); that was virtually all. His final concern with entomology appears almost casual. When he retired from the Museum in 1840, he put his collection of insects and entomological books up for sale, resigning from the Entomological Society the next year. In the words of its history he 'appears not to have further interested himself in Entomology after that date' (Neave & Griffin, 1933 : 120).

The new British Museum, 1828

From the mid-1820s the East Wing of the new British Museum, the first part of Robert Smirke's quadrangle, was to be seen rising to the north of Montagu House and plans were under discussion for the transfer of the collections. In July 1828 the books of the King's Library from Kensington Palace were the first to be moved in. In December the Trustees enquired of the Natural History Branch on the then size of the collections and their expected growth, to judge whether they would fit into the galleries reserved for them.[28] An inspection early in 1829 by König and Children, who had evidently not been consulted earlier, revealed so serious a lack of light that the architect was asked whether a row of windows could not be let into the east wall.[29] When told that this was structurally impossible, a partial solution was suggested in the removal of the interior fittings to the sky-lights.[30]

It was anticipated that the new galleries would be ready for the zoological collections by April, when the Trustees ordered that the

> '... zoological collections should immediately be transferred to the New Gallery, fully expecting that sufficient space will be found for the Collections.'[31]

In June, however, Children was still being told 'to commence forthwith arrangements for Zoology in the New Gallery', and in July, for 'the Shells to be transferred as soon as possible into that part of the New Gallery that is over the MS Library'.[32] There were, of course, the usual problems involved in such a move. For the new galleries the old upright cases needed to be deepened and the sides glazed. There were to be 20 new table cases, new bird stands and stoppered bottles for reptiles. All these – if not too large – were to be displayed to the Trustees at their Meetings.[33]

In spite of these urgings, the birds were not moved until February 1830 when it was decided that the mammals, reptiles, molluscs and fishes were to remain in Montagu House in the three rooms previously occupied by the Banks Library.[34] Thus the staff were as much occupied with the rearrangements in Montagu House as with the transfer into the new galleries. But by November 1830 progress was sufficiently advanced for the question of specimen labels to be raised. When it was found that the cost of printed labels 'greatly exceeded' hand-written ones, a Mr Mackenzie was engaged at a guinea a week to write them.[35]

Work on the Montagu House collections was always in arrears because of the lack of general assistance; moreover, the complicated procedure for adding staff further delayed any formal application until 1828, when:

> 'Mr. Children having respectfully submitted to the Trustees that a person is extremely wanted in the Zoological Branch of the Department of Natural History, who in addition to his normal duties of the servants of the Department possesses a knowledge of preserving animals, and that a person of the description might be obtained at the pay of one guinea a week.
>
> Resolved —
>
> 'That Mr. Children's representation be laid before His Grace the Archbishop of Canterbury with a request from the Committee that his Grace and the Principal Trustees will take the propriety of making such an appointment into their consideration.
>
> Ordered —
>
> 'That the Principal Librarian undertake the reprinting of the Acts and Votes of Parliament relating to the British Museum, with the Statutes and Rules thereof, and the succession of Trustees and Officers; and that an 100 copies of the same be printed for the use of the Trustees.'[36]

As a result a Mr Dietrichsen was appointed a year later as stuffer and preserver of animals at 25 shillings per six-day week; although this is the first and last we hear of him, once the collections housed in the new building started to expand, there was more than enough work to employ an attendant full time.[37] Now that the ice had been broken, requests for additional staff became less of a formality and soon Children was again indenting for an Attendant, perhaps to replace Mr Dietrichsen, as he was to do yet again with increasing urgency in the 1830s with the second stage of the move in prospect.[38]

In fact, two additional naturalists were engaged in 1831, before the move, George R. Gray (1808–1872) and Adam White (1817–1863). Gray was the brother of John Edward Gray, and he at once took over the bird collection from his brother. His presence in the Museum on the morning of 21 October 1830 does not appear to have received the approbation of the head of the Department:

> 'Mr. König presents his complements to Mr. Ellis [Principal Librarian] and begs to acquaint him that there is at this moment, that there has been for a considerable portion of this morning, a person unknown in Mr. König's Department (but who he understands is the brother of Mr. Gray, extra assistant in that department) engaged in arranging objects of Nat. History, in two of the rooms adjoining the Saloon. Hearing from the secretary that no appointment of an additional assistant in his Department has taken place, Mr. König considers it his duty to give this information not doubtful that Mr. Ellis will see the necessity of immediately putting a stop to this enormous irregularity.'[39]

The intruder was to give 42 years' service. For the first 12 months, however, he was employed without pay until in September 1831 he was placed on probation for another 12 months at 15 shillings for each working day. In May 1835 Children's 'indispensably necessary' appeal to the Trustees led to the appointment of Adam White, an Edinburgh boy of 19 who was paid £70 for his probationary year, £80 for his second and thereafter at the regular assistant's rate of 15 shillings per day.[40]

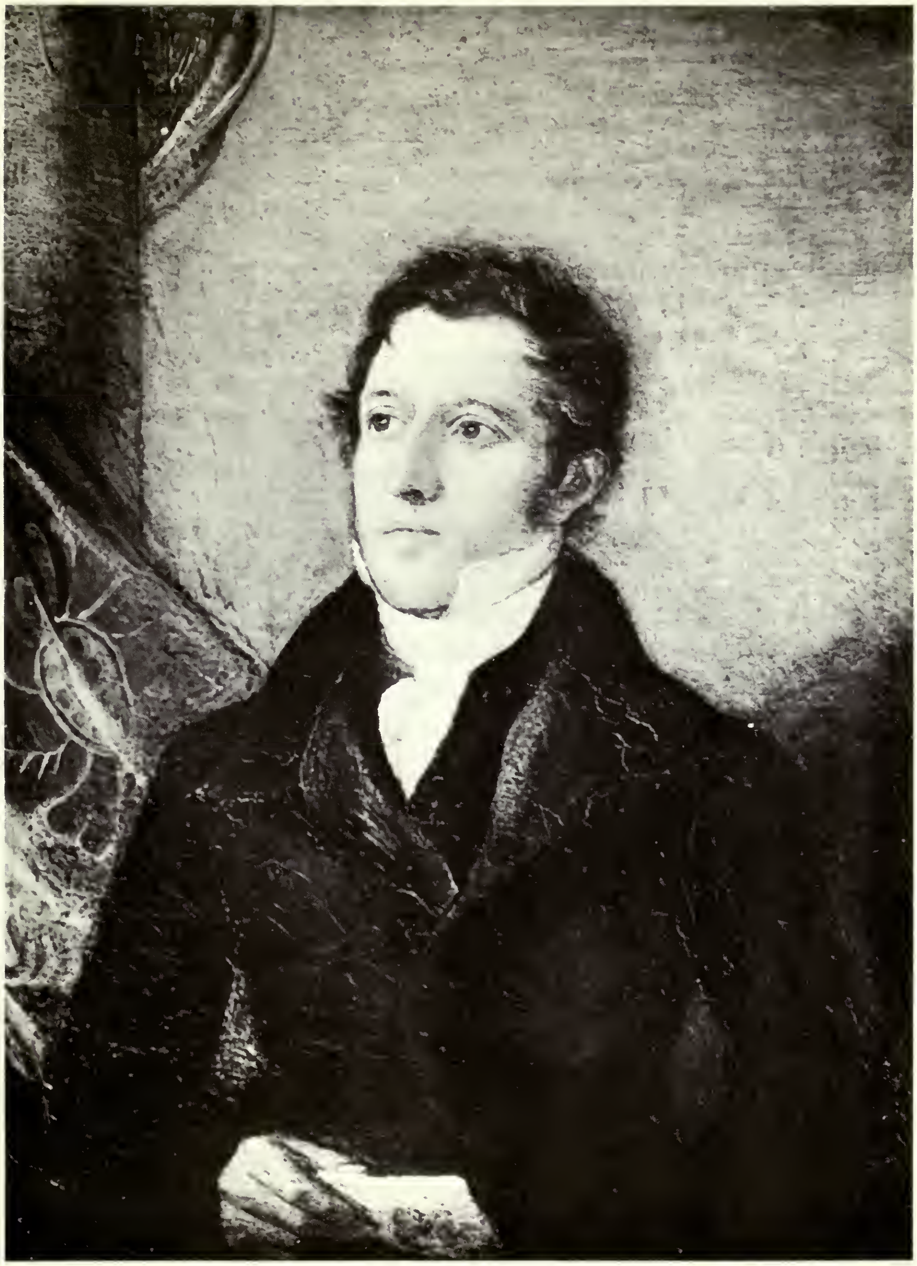

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Fig. 2 John George Children (1777–1852), Keeper of the Natural History collections at the British Museum 1822–1840. Oil painting by an unknown artist of Children during his time as Secretary of The Royal Society (1830–1837). Presented to the Royal Society by John Edward Gray in 1873. (Portrait not at present available).

Secretary of the Royal Society, 1830

By the end of 1830 the transfer of the collections to the East Wing was complete and the new galleries were to be opened to the public in January 1831. The result was to attract a flood of specimens from collectors all over the world, such as those sent by General Hardwicke from Africa in 1830, Gould's from the Himalaya in 1832, Audubon's from North America, A. H. Haworth's (1768–1833), John Macculloch's (1775–1835) and those of many others.[41]

Children was now 54, within a measure of retirement. With this major undertaking completed but lacking an interest in the systematics of natural history, such as kept his principal assistant, J. E. Gray, endlessly busy at his lists and catalogues, one suspects he looked for a wider field of activity than offered by the department. He found it, accepting for the second time and, it is said, both unwillingly and against his better judgement, the Secretaryship of the Royal Society, which he held for the next five years. The pressure came on this occasion, one must assume, from Augustus Frederick, Duke of Sussex (1773–1843), the sixth son of George III and Queen Charlotte and who, himself a scientist, had been elected President of the Royal Society in 1830, remaining so until 1838 (Henderson, 1885). Children had met the Duke, then on a visit from Rome, in Lisbon in 1801 and a friendship of some warmth was preserved over the years. Unfortunately, in deference to royalty, his family felt it incumbent upon them to destroy the Duke's letters (Atkins, 1853 : 33). The record of the lists of Officers of the period show that he served with J. W. Lubbock (1803–1865), Vice-President and Treasurer (Clerke, 1893), Peter Mark Roget (1779–1869) as Joint Secretary (Webb, 1897), and with Charles König as Foreign Secretary (Anon., Royal Society, 1837, **3** : 90,360).

This period of Children's secretaryship was not marked by any outstanding event, unless by the Presidency of the Duke of Sussex. In 1832, the *Catalogue of the Royal Society Scientific Books*, to be published in 1839, was put in hand and, together with Lubbock, Children joined in editing the *Abstracts of the Papers of the Philosophical Transactions*, Vol. III, 1830–1837 (Anon., Royal Society, 1837), a task which could not have been other than a tedious chore. Children's relations with the President, to judge from a series of letters to Lubbock, were those of a dutiful and tactful personal secretary rather than of an eminent scientist assuming a secretarial function. He would wait on the Duke at the royal apartments at Kensington Palace to receive his commands, if need be taking breakfast there 'at half past ten exactly'. Children's resignation in 1835, partly on the grounds of health and partly because of the demands of the Select Committee, drew a unanimous resolution from the Council:

> 'That the thanks of the Society be given to their Secretary, John George Children, Esq. for the zeal and ability which he uniformly displayed, and the many valuable services he has rendered, in promoting its objects.'
>
> (*Proc. Roy. Soc.* No. 23, 1835–1836, 10 Dec. 1835)

In 1833, Children was largely responsible, as honorary secretary of the committee, for organizing the commemoration of the birth of Joseph Priestley (1733–1804) by a dinner at the Freemasons' Hall, where he joined others in speeches and replied to the toast of the British Museum (Anon., 1833).

Select Committee on the British Museum, 1835–1836

The Minutes of the Trustees of the British Museum of this period are a constant reminder of how closely the Trustees were involved in the day-to-day running of the Museum, and how the consciousness of their responsibility seemed to prevent them from delegating decisions to the Keepers or even to the Principal Librarian. The latter's duties were rather more those of what would be called today an 'Assistant to the Directors', rather than of a director himself. Thus, they did not hesitate to reprimand him in formal minutes if they considered he had erred or, in the contemporary jargon, that he had merited their opprobrium. At a lower level, the Keepers were subject not only to detailed control of their expenditure, which was natural enough, but they had also to seek the approval of the Trustees for the way in which they allocated their 'free' time, for which they were paid. Approval for their suggestions would come via the Minutes from the Secretary, the Rev. Josiah Forshall, in the form of a formal resolution. It could happen also that instructions to Keepers would go beyond what was practicable, but there seem to have been few examples of this.

Criticism emanating in May 1833 from outside the Museum probably led the Trustees to enquire about the state of the Shell Collection:

> 'That Mr. Children report how far the several Collections which he more especially superintends are arranged and ticketed with their proper names; and this particularly with respect to the Shells, and within what time the last mentioned Collection will be completely named and the names attached to the several specimens.'[42]

In great haste Children turned to Dr Gray:

British Museum
4th June 1833

(Draft)

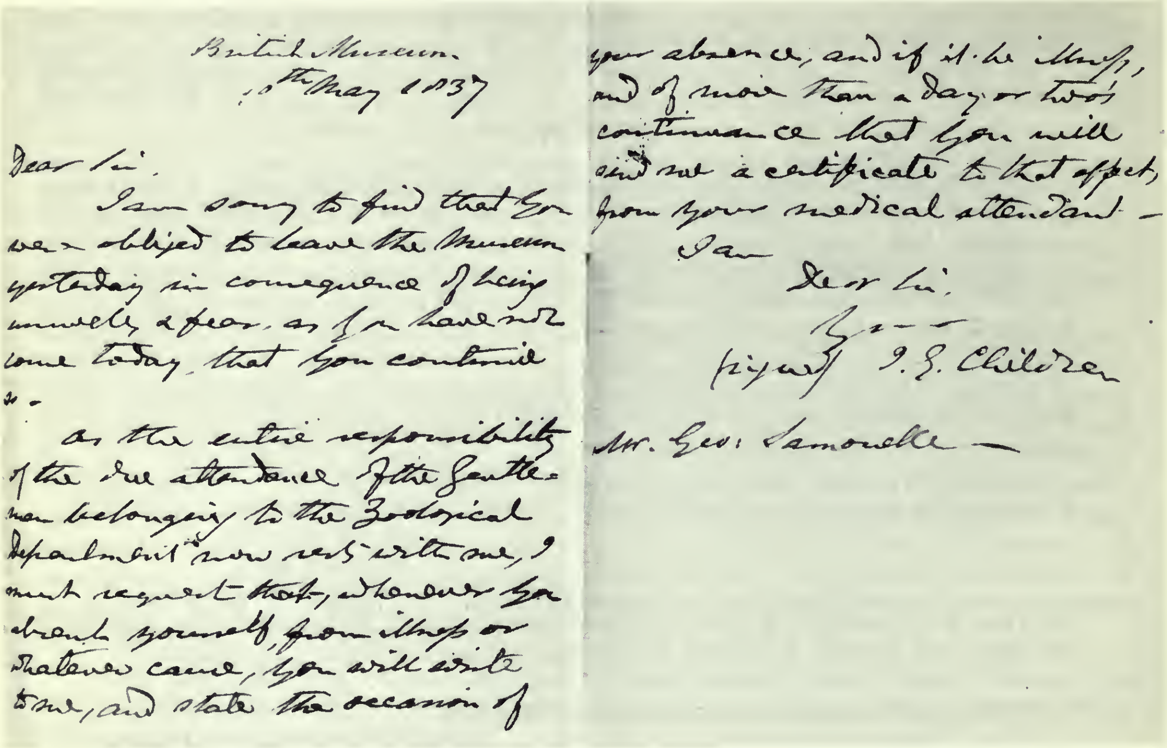
> 'My dear Mr. Gray,
>
> I have received an order from the Trustees of a very unpleasant nature. It refers more particularly to the general Collection of Shells. I shall report in a way that I hope may be satisfactory, but I must request at all events that you will suffer *nothing* to interrupt the progress of *naming* the Collection with the *utmost possible dispatch.* What I require is that you will have the goodness to give George [G. R. Gray] the names (written in pencil at the bottom of the boards) of all the Species which you know off hand, and in the meantime I will make out such of the others as I can find figures or descriptions of, so that (?) they be all working at on a definite object, (for I shall leave the Corals for the present), and I again must most positively insist on no other interfering with its progress till every shell in the Collection be named unless an order to that effect, be given by the Trustees themselves.
>
> Your brother's *whole time must be devoted* to writing the names on the boards, and I beg he may not be employed in *any other manner whatever,* without my express approbation.
>
> Ever my dear Gray
> faithfully yours
> John Geo. Children.
>
> PS. There is no necessity for placing the Shells first purchased, on boards, till they have been laid before the Trustees. I beg they may be shown *in the Lots,* exactly as purchased.
>
> J. G. C.
>
> The price of each Lot must be given in at the same time.'[43]

If it is thought that Gray, because of his lack of status, escaped the opprobrium of authority, the following note to Children from the Principal Librarian serves to straighten the record:

> 'The Persons who come to Mr. Gray's Room are stated to me to be so very numerous, that they must, interfere with the performance of his official duties.'[44]

To provide details of most of the years of Children's Keepership this account has relied on records from outside sources, as well as the few publications from his own hand. However, from 1835, and including a few from 1828, there have survived, not only the official memoranda and letters of the Natural History Branch which passed between the Secretary of the Trustees and the Keeper, but also Children's personal Report Book in which he made notes or drafts of his replies. Here an untidy handwriting, which deteriorated over the years, reveals some of the strains to which he was subject until, in 1837, corrections to his drafts begin to appear in the hand of J. E. Gray.[45]

These records coincide with the appointment in 1835 of a Select Committee of the House of Commons to 'enquire into the Condition, Management and Affairs of the British Museum' (Parliamentary Papers, 1836). The move into the new building had utterly changed the pace of Museum life, exposing it to the public gaze and showing up the deficiencies in what was now recognized as a national institution. Its fine new galleries were attracting, from proud donors, an avalanche of gifts and collections from all over the world; a wider public thirsted for cultural 'amusement', as it was called, and the work of the staff was becoming progressively subject to the critical attention of a growing class of scientists, both professional and amateur, who had established a number of learned societies in the subjects studied at the Museum. It was, of course, difficult for a body of elderly trustees, dependent on a strictly controlled Treasury grant, to realize that the provision of a new building was merely the first step towards what the new public – who had seen what the French, defeated in war only twenty years before, were making of their *Muséum d'Histoire Naturelle* in Paris – were now calling for.



British Museum.
10th May 1837

Dear Sir.

I am sorry to find that you were obliged to leave the Museum yesterday in consequence of being unwell, & fear, as you have not come today, that you continue so.

As the entire responsibility of the due attendance of the Gentlemen belonging to the Zoological Department now rests with me, I must request that, whenever you absent yourself, from illness or whatever cause, you will write to me, and state the occasion of your absence; and if it be illness, and of more than a day or two's continuance that you will send me a certificate to that effect, from your medical attendant –

I am
Dear Sir,
Yours
(signed) J. G. Children

Mr. Geo. Samouelle –

Fig. 3 Letter from J. G. Children to G. Samouelle, from *Letters and Reports, Zoological Branch British Museum, being memoranda exchanged between the Secretary of the Trustees and the Keeper, J. G. Children*, 1828–1840, ff. 58, 59. (British Museum (Natural History), General Library).

The Committee's enquiry began in May 1835 and concerned itself first with the literary side of the Museum's work. In July came the turn of natural history, Charles König was called first, followed by Children on 24 July, and then the other members of his staff. For Children the exposure to public questioning, which continued until the 1836 Session of Parliament, could not have been other than a chastening experience. He was then in his 58th year and not in the best of health. Technically unqualified for the position he held, he did not have the command of detail that would sit more lightly on a younger man involved in the day-to-day work. Moreover, his examination by the Committee, lasting one full day, was followed by that of his assistant, J. E. Gray, for two days in 1835 and again for another four in 1836; finally he was recalled to reply to the outspoken criticism of Dr Robert E. Grant (1793–1874) (Boulger, 1890), Professor of Comparative Anatomy and Zoology in the University of London:

> 'I conceive that, compared with the corresponding institutions of our Continental bretheren, the zoological collection of our National Museum, and the management of that collection, are an opprobrium to the British nation and these enlightened times'.
>
> (Parliamentary Papers, para. 315, 25 Feb. 1836)

It was an accusation that visibly nettled the Trustees who sent at once to Children asking for an explanation and received the answer that if the collections were to be looked at in detail rather than generalized about, then the generally accepted truth would emerge; that the zoological collections at the British Museum had at that time no equal in the world. (P.p. 1836 : 2781–2897, 28 April; Children, 1835–1837, ff. 33, 37). But this was Gray's work, not his, and it was Gray who gave the Committee what it was seeking: a detailed analysis of the situation relating to the science of zoology in Britain and on the Continent, followed by a clear and purposeful outline of the policy for its organization and development within the Museum.

Little wonder, then, that in the life of her father Anna Atkins dismisses the work of the Select Committee (incidentally one of the most important in the Museum's history) as

> '... a great and by no means agreeable consumption of valuable time.'
>
> (Atkins, 1853 : 264)

The adjournment of the sessions of the Select Committee from August 1835 to February 1836 gave those involved time to take stock of what had so far emerged; as concerned as any were Children, Keeper of Zoology, and J. E. Gray his assistant, still without a formal position and still paid only 15 shillings per working day. In the dozen years since Gray had joined Children, their personal relations had been, on such evidence as there is, harmonious. But the evidence given by each before the Committee, if not contradictory, was at least very different in tone and could hardly leave things as they were; for this there is evidence in the draft of a letter found amongst Gray's papers (Gray, *c.* 1862–1874, MSS.).

In his annual report of March 1836, required by the Trustees from each assistant, Gray had appended a *Memorial* (Gray, 1836). This, after explaining the nature of his duties and situation in the Branch since he joined it in 1824, asked that he be considered for the post of Assistant Keeper. As courtesy required, he showed the *Memorial* to Children, who made no objection. But when the Trustees turned the petition down Gray, without Children's knowledge, wrote a personal letter to one of the members of the Select Committee, probably its Chairman, Mr Benjamin Hawes, M.P. (1797–1862) (Boase, 1891), complaining both of Children's competence as Keeper and of his personal behaviour. Although there remains some doubt as to whether this letter was actually sent, the questions Children was asked when recalled for an extra examination by the Select Committee on 28 April 1836 suggest that it was. Omitting charges of a purely personal nature, since to include them would be making too much of a transient tension between the two men, the following is a fair statement of Gray's case.

> Letter from J. E. Gray to some person, either a member of the Select Committee on the British Museum 1835–1836 or to someone close to its affairs.
>
> 'Dear Sir,
>
> I am extremely sorry again to trouble you with a letter but . . . I wish to draw your attention [as you] asked [during] our conversation . . . knowing that you are a friend of Mr. Children, and one interested in the business of the British Museum. I greatly regret that I feel myself under the necessity of complaining of the conduct which I have received from Mr. Children, because I feel myself greatly indebted to his former kindness; indeed I may say that I have almost all the regard for him that a son would bear a father, but still I cannot allow these feelings to prevent me from doing my duty towards the Museum and acting honestly with myself.
>
> 'It was this feeling which induced me always to keep as much as I could from the public, both in the Museum and in the evidence before the Committee, the little attention that Mr. Children paid to the Department, to leave out any mention of his recent conduct towards me, or my official services to the Museum in my late *Memorial* to the Trustees, as I felt assured that if the Trustees placed me in any situation on the establishment, that then Mr.

> Children would not think of acting towards me [as he has of late] (?) . . . but the Trustees having seen fit to refuse my request, I am now placed even in a more uncomfortable situation than I was before, as Mr. Children, though he [was] pleased to say, when I showed him the *Memorial*, that nobody could deserve to be promoted more than I did. . . .
>
> 'It must be well known to you that Mr. Children has given very little attention to the study, or very little time to the business of the Department, especially since he has been Secretary of the Royal Society, his time being much occupied (once a week at least) on attending on, or conducting the business of the President, and on reading and correcting the papers to be read or published by the Society. Seeing that this was the case, I have exerted myself to the utmost (often by working during the greater part of the night), to do my own duties as well as those which ought to belong to Mr. Children, so that the business of the Department should not be neglected, always consulting Mr. Children and letting him have as much credit in the Museum as he wished, and I have always followed his directions, only mildly giving him my reasons why I thought that some other plan might be better. . . .
>
> '. . . and further, when the conduct of the junior assistants of the Department are taken out of my hands and they are made quite independent of me, through Mr. Children, from his not being in the Museum cannot exercise sufficient control over them; and lastly when the only attendant in our Department is often sent away during the private days, the only one I could employ for any more laborious occupations, is being usually sent out on Mr. Children's private business. . . .
>
> 'I presume, moreover, [I have been presumptious when,] hearing that he has often denied to persons who came to consult the Collection etc., I have always held myself in readiness to see everybody and give him every facility (?) in my power, and it is my pride that I am able to say that during the time that I have been in the Museum, I have used every endeavour that the Collection should be [in] the best possible condition for public reference . . . and we are now in the Committee, receiving the praise of all parties for this facility and attention to the public.
>
> I am Dear Sir,
> Your humble servant,
> John Edward Gray.'
>
> (Gray, *c.* 1862–1874, MS. ff. 124–125)

The third day of Gray's resumed examination by the Select Committee, 28 April 1836, was interrupted by Children's recall. Children, asked a question about his work as Secretary of the Royal Society, replied that it occupied only one day a week, and even that after the Museum had closed its doors at 3 o'clock; however, this denial is hardly borne out by mention in Children's letters of the calls made on his time by the Duke of Sussex, then President of the Society. When Children was asked whether Gray was conscientious in his duties, he emphasized that gentleman's 'fidelity to his task' by asserting that he 'never saw Gray otherwise engaged than in the interests of the Trustees when in the Museum' (P.p. 1836, para. 2895) – a sentiment that may have helped their friendship but did little for Children's health; the publication of the Select Committee's Report in July found Children on a month's absence on sick leave.

There were undoubtedly other occasions of friction than that of Gray's refused promotion between a tired and ageing Keeper and his assistant; one such occurred on 7 April 1837 when Children, complaining that Gray had not followed the directions of the Principal Librarian in completing his monthly report with the 'actual duty performed', had refused to accept Gray's reason and returned his letter.[46] But the best testimony to their relationship appears in the support given by Children to Gray's candidature for the Royal Society:

> 'Mr. Gray is the best naturalist that I know, especially for his very extensive acquaintance with species in almost every department of Natural History, including fossil remains. He is also a good physiologist and comparative anatomist, and will be very useful in all these branches of science. He is attached to the British Museum. His name was suggested by Dr. Roget.'
>
> (Royal Society, Lubbock Letters, LUB.C.179, 12 July 1833)

Between the publication of the Select Committee's Report in July 1836 and his retirement in 1840, Children was concerned firstly with the rearrangement which the Trustees accepted from the Committee's recommendations, and secondly with the next phase of the move of the collections from Montagu House to the new building.

The Natural History Department was divided in 1837 into three equal and autonomous Branches – Departments from 1856 – of Mineralogy and Geology, Zoology and Botany which made Children, now Keeper of Zoology, finally independent of Charles König. Each Branch received an allocation for the purchase of specimens, Zoology receiving £800 a year, and another £800 for preservation.[47] From 25 March 1837, a *Catalogue of Accessions* was maintained by the Zoological Branch, the first volume being in J. E. Gray's hand, which continues to this day.[48]

A revision of salaries in March 1837 gave Keepers £600 a year and Junior or Assistant Keepers £450, with an extra £30 after 15 years' service. At that time, J. E. Gray, still not rated as Assistant Keeper, was paid £275 a year, to include Saturdays, and allowed one month's vacation (28 March, f. 55).[49] The departmental Assistants were also upgraded from 7 shillings a day in the first year to 11 shillings a day after 5 years, finally after 10 years receiving £180 a year. From then on the system of 'free days' was abolished, and staff were required to place their 'whole time and service at the disposal of the Trustees' for 6 days a week, being allowed 6 weeks' vacation each year.[50]

Instructions to staff were received, if not through the Secretary of the Trustees, from Henry Ellis (1777–1869), the Principal Librarian since 1827, an able and hard-working man devoted to the betterment of the Museum. Orders to Keepers were passed on to the remaining staff in the form of letters, thus:

> 'From J. G. Children [*Draft*] British Museum
> 7 April 1837
>
> To Messrs. J. E. Gray
> G. Samouelle
> G. R. Gray
> A. White
>
> . . . a letter which has this morning [been] recd. from the P.L. from which they will perceive that their Reports must in future specify *the actual amount of Duty performed from Month to Month* – and that they must state to me (Sir Henry Ellis' own expression) "where they began" at the commencement of each period, and "where they ended at its conclusion".
>
> These gentlemen will, therefore, henceforth report *the number of Genera and Species* which they have *named, catalogued and arranged in the cases*, Month by Month, as Mr. Children *will reject every report which does not strictly comply with the direction of the Principal Librarian.*
>
> John George Children.'[51]

In December this order was amended to require the keeping of *Diaries* signed by the Keepers which, as Work Books, were retained for many years.[52] In May 1839 staff were accorded the privilege of submitting their own Annual Reports,[53] whilst in January 1840, perhaps in anticipation of Children's successor, the Principal Librarian required

> '. . . a precise Statement of the progress made in the arrangement of the collections . . . and of the printing, or preparation for printing, Catalogues of the Collections subsequent to the reports made to the Trustees in June 1838'.[54]

The new British Museum, transfer, second phase, 1838–1841

Plans for the second phase of the move from Montagu House into the North Wing of the new building had been outlined in 1835 when the estimate, in Gray's hand, of the display space required was two to three times what there then was: glass-fronted show cases increasing from 633 to 1828 linear feet, and table cases from 42 to 68.[55] Meanwhile the Trustees urging a revised edition of the *Synopsis of the British Museum*, Children's reply was that this could not be carried out until the move had been completed, and would then require two separate publications: a systematic catalogue for the student and a popular guide for the public.

In 1837 a provisional allocation of space in the North Wing gave Minerals and Fossils (then in the Long Gallery of the East Wing) the northern row of galleries; into these, with some difficulty, König fitted them in May 1838.[56] Natural History (zoology) presented little difficulty; the furniture was ordered in 1838, the dispositions agreed in 1839, and in 1840–1841 the collections in the East Wing were rearranged to allow for the final transfer from Montagu House. Apart from an extension of mammals into the South Wing as far as the Pediment, the collections remained approximately as Children and Gray ordered them until the move to South Kensington in the 1880s. But Children's request for a room for the Assistants and for three study rooms for zoologists fell on deaf ears.[57] A point of incidental interest is that, in preparation for the move, Children turned his attention to the fish collection.

Retirement, 1840

It may be asked why Children, now approaching 60, did not retire in 1837 after the findings of the Select Committee had been implemented. 'Le fin', he was fond of saying, 'couronne tout.' Whether in view of the shortage of staff he had the Museum's interest at heart, or whether he wished to share in the historical event of the final transfer of the Collections from Montagu House, must remain a matter of conjecture. Children's inclinations were those of an 18th-century man of science, used to dilettantism rather than the mundane day-to-day affairs of the 19th century, made increasingly burdensome by a precarious health.

> 'The increasing business in his, as in every department of our national Museum, consequent on the almost daily acquirements of fresh objects of every kind, required exertions which were serious in the state of his nerves and health.'
>
> (Atkins, 1853 : 268)

It was the death of his third wife, Eliza, in September 1839, and the three months of disability which followed, that finally led him to the decision to retire.

> '. . . by necessity, not choice, a man of considerable toil . . . for some time desirous to quit the Museum . . . yet he was now daily feeling how needful rest and leisure were becoming for him.'
>
> (Atkins, 1853 : 271)

At the end of the year he waited upon Dr William Howley (1766–1848), the Archbishop of Canterbury (Barker, 1891), who prayed that he should not find freedom from labour more tedious than labour itself. The manner of his going reflected the respect the Trustees had for the man, socially one of themselves, since expressions of approbation are not usually found in their Minutes. Children's letter of resignation of 25 March 1840 inspired the General Meeting of the Trustees to a resolution:

> 'That the Trustees received with regret the announcement of the resignation of Mr. Children of his Office of Keeper of the Zoological Collections, and think it due to Mr. Children to record upon their Minutes the sense which they entertain of Mr. Children's meritorious services in the Museum during the long period of 24 years.'[58]

In retirement, poor health denied Children the chance of doing productive work. He retained his London residence at 48 Torrington Square, but resided mainly with his son-in-law, John Atkins, who married his daughter, Anna, in 1825, at Halstead Place, Enfield, then out in the countryside.[59] Although he frequently travelled for 'change' on medical grounds, his life was one of enforced leisure; he rarely enjoyed consecutive days of health but when he did he expressed his relief in verse. On being invited in 1847 by the Rev. F. P. Bliss, of St John's College to stay at Oxford during the British Association Meeting, he replied:

> 'I really am in that uncertain state as to health, that I cannot answer for myself from day to day, my old complaints have brought on a distressing state of the general surface of the mucous membrane of the throat and nostrils and which kept me for some days in almost constant state of coughing and nose bleeding – to the great discomfort of myself and annoyance of all around me. . . .'[60]

With such strength as remained to him, he returned to the lathe-work of his school days, but the subject which absorbed him was astronomy and he bought a fine new telescope. As in the case of chemistry, he had lectured in the subject with an amateur proficiency.[61] In 1844 he supported the founding of the Ray Society[62] and in 1847 made a final contribution to the *Philosophical Journal*, appropriately enough on an explosion which followed 'the use of a mixture of spirits of wine and camphine and oxygen gas as a light for optical purposes' (a magic lantern) (Children, 1847). In November 1848 he spent nights observing the transit of Mercury.

Towards the end of 1851, at the age of 74 the years took their toll and John George Children died on New Year's Day, 1852. His burial service was held in St George's Bloomsbury on 9 January.[63] It is believed, but not certain, that Children was buried in the same grave as his third wife, Eliza, in the St George's Burial Ground, north of the Foundling Hospital, now named St George's Gardens. Several other members of the staff of the British Museum lie interred in the same place, but no trace of a monument to Children remains.

Acknowledgements

The preparation of this paper has depended on access to records at the British Museum, the British Museum (Natural History) and the Royal Society. At the Royal Institution its archives and minute books have also been placed at my disposal by the Librarian, Mrs I. McCabe. The officers of the Kent County Council in the County Library at Tonbridge–Malling (Miss S. J. Hardy and Mrs G. Hodge) also gave me free access to their records.

At the British Museum (Natural History), in the Department of Mineralogy, the Keeper, Dr Clive Bishop, and Dr Peter G. Embrey suggested additions to the text which also received most helpful criticism throughout from Dr David Kempe. Thanks are due to Dr J. G. Sheals, Keeper of Zoology, Mr John F. Peake and Dr Peter Whitehead for various suggestions. Mr M. J. Rowlands, the Chief Librarian of the General Library, has given constant support to the research both within and outside the Museum. Mr John Charles Children of Tonbridge, now head of the family, and Mr Michael Bushby, Housemaster of Ferox Hall, have both contributed valuable information.

Notes

1. Confusion between the spelling of the names Tonbridge (earlier often written Tunbridge) and Tunbridge Wells calls for an explanation. Tonbridge, important because on the Medway and on the road from London to Hastings, goes far back into English history. On the other hand, the chalybeate springs at Tunbridge Wells (the wells of Tonbridge/Tunbridge), discovered in 1606, brought the start of a town there in 1680, which in the 19th century outgrew Tonbridge. There was no uniformity in the spelling of the names of the two places until 1893 when the Tonbridge Local Board responded to approaches by the Post Office and the South Eastern Railway Company.

2. Ferox Hall, Tonbridge, dates at least from the 13th century; every century since has seen changes. Its appearance today is that of a building with an 18th-century core, enlarged to the needs of a boarding house for a school, founded in 1553 (Hoole, 1970).

3. Harrison, William Jerome, F.G.S. (1845–1909), *Who Was Who*. On George Children, *Dictionary of National Biography*, **10** : 249, 1887.

The present head of the Children family, Mr John Charles Children (b. 1919) has a Pedigree going back to about 1400, but his is a different branch from that of John George Children. The Pedigree was compiled by G. M. G. Woodgate (Woodgate & Woodgate, 1910) in 1927, and has since been added to. The records, Children MSS. (U 1866), are preserved in the County Hall, Maidstone.

4. Jordan, John Thomas, Queens' College, Cambridge, 1772–1775, later Rector of Hickling, Nottinghamshire. His niece married Lewis Madden, brother of Sir Frederick Madden of the British Museum (*Graduati Cambridgensis*, and Atkins, 1853 : 11, 170).

5. Camden, Marquis of (1759–1840), John Jeffreys Pratt, 2nd Earl; seat, The Wilderness, Sevenoaks, Kent; politician, later Secretary of State for War. Joined Children sen. in founding the Society for Encouragement of Agriculture in Kent; Trustee of Tunbridge Wells chapel etc. (*D.N.B.*, 1896, **46** : 209; Woodgate & Woodgate, 1910 : 334, 351, 353 etc.).

6. Royal Society, Register of Election, 12 March 1807. See also, Thompson, T., 1812, *History of the Royal Society*.

7. Writers on the history of galvanism seldom fail to describe the Childrens' voltaic battery. It consisted of 20 copper and zinc plates, each 6 ft long and 2 ft 8 in. wide, which, suspended from the roof, could be lowered into a tank containing 945 gallons of dilute acid (Children, 1815 *Phil. Trans. R. Soc.* **105** : 363–374).

The acid solution used by Children comprised 3 parts fuming nitrous, 1 part sulphuric acid, diluted with 30 parts of water.

8. The Fellows of the Geological Society who are on record as having attended experiments were: William Babington (1756–1833), who suggested the use of vessels of Wedgewood ware, William Hyde Wollaston (1766–1828), William Allen (1770–1843), William Hasledine Pepys (1775–1856), Henry Warburton (1748 ?–1858) and William Thomas Brande (1788–1866). Of these Allen and Pepys were the most frequent witnesses.

9. An account of this visit was written by Children in a letter from Brussels on 30 September 1818; it was intended for *The Times* but was not published until 27 November 1852 when it appeared in *The Illustrated London News*, a month after the Duke of Wellington's death (Atkins, 1853 : 193).

Publication was preceded by the gift to the Royal Gardens, Kew, by S. F. Gray, of a snuff-box made from the elm; it was called by *The Times* of 5 October 1852 a 'very interesting relic'.

10. B.M. Trustees Minutes, 1816, C.2638, 2644.

11. B.M. Trustees Minutes, 1817, C.2663, 2684.

12. President of the Royal College of Surgeons.

13. B.M. Trustees Minutes, 1821, C.2770.

14. B.M. Trustees Minutes, 1822. C.2808.

15. B.M. Trustees Minutes, 1824, C.2891.

16. B.M. Trustees Minutes, 1818, C.2704.

17. B.M. Trustees Minutes, 1826, GM.1268.

18. B.M. Trustees Minutes, 1822, GM.1192.

19. B.M. Trustees Minutes, 1822, GM.1193.

20. The annotations in the Museum's copy of Lamarck's *Histoire Naturelle . . .*, Vols. 6 and 7, are almost exclusively by J. E. Gray, although another hand may also have been involved. (See Gray, J. E., 1847, List of the genera of Recent Mollusca, *Proc. Zool. Soc.* **15**.)

21. In Montagu House the Shell Collection was in Room IX (or L). The arrangement made by E. W. Gray was based on the work of Linnaeus and Gmelin in the tenth and twelfth editions of the *Systema Naturae*. The *Synopsis of the British Museum* records the following numbers of table cases of Shells: 1809, 1; 1827, 27; if another 17 or so were added in 1829, the total on the move into the New Building would have been, say, 44. B.M. Trustees Minutes, 1829, C.3190, GM.1340.

22. B.M. Trustees Minutes, 1826, C.2983.

23. B.M. Trustees Minutes, 1826, C.2983, GM.1267.

24. Although the Atkins biography makes frequent reference to Children's health, there is little specific detail from which a diagnosis can be made. In the Davy letters between 1808 and 1813 there is mention of gastric trouble, but during the London years one letter (Children, 1846–1847, ff. 404–7) suggested that his 'old complaint' was chronic sinusitis, not hay fever; there could also have been nasal catarrh with polypi and infection of the mucous membrane. It is not known if in those days it was the custom to operate for such a condition.

25. B.M. Trustees Minutes, 1821, GM.1186.

26. B.M. Trustees Minutes, 1826, C.2969, 2973.

27. Mr John Fuller, M.P. (1757–1834), wealthy iron manufacturer aiming to encourage science, elected Annual Subscriber of the Royal Institution on 17 February 1800 (Archives, p. 129), also Manager (*Proc. Roy. Inst.* **44** (205): 331–337, 18 March 1971). His grandfather John Fuller, M.P. (d. 1755) was an executor of Sir Hans Sloane's will.

28. B.M. Trustees Minutes, 1828, C.3138.

29. B.M. Trustees Minutes, 1829, Sub-Committee, 23, 26.

30. B.M. Trustees Minutes, 1829, C.3177.

31. B.M. Trustees Minutes, 1829, C.3165.

32. B.M. Trustees Minutes, 1829, C.3190, GM.1340.

33. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, ff. 4–6.

34. B.M. Trustees Minutes, 1830, C.3231/2.

35. B.M. Trustees Minutes, 1830, C.3285.

36. B.M. Trustees Minutes, 1828, C.3062/3.

37. B.M. Trustees Minutes, 1829, C.3169.

38. B.M. Trustees Minutes, 1829, C.3202.

39. B.M. MSS. 1835–1845, **45** : f. 1.

40. B.M. MS. J.G.C. Report Book, 1835–1837, f. 5.

41. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, f. 21.

42. B.M. Trustees Minutes, 1833, GM.1451.

43. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, f.12.

44. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, f. 16.

45. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, and BM (NH) MS. J.G.C. Report Book.

46. B.M. MSS. Zoological Branch, Letters and Reports, 1849–1853, **49** : ff. 197–198.

47. B.M. Trustees Minutes, 1839, Sub-Committee, f. 143.

48. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, f. 92.

49. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, f. 55.

50. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, ff. 45–46; and B.M. Trustees Minutes, 1837, C.4485/6.

51. B.M. MSS. Zoological Branch, Letters and Reports, 1828–1840, f. 56.

52. B.M. MSS. Zoological Branch, Letters and Reports, 1837, f. 67.

53. B.M. MSS. Zoological Branch, Letters and Reports, 1838, ff. 134–140.

54. B.M. MSS. Zoological Branch, Letters and Reports, 1840, f. 152.

55. The initial scheme for the New Museum, in the hand of J. E. Gray, is dated 12 December 1835, entitled 'Report to Mr. C. [Children] on the space required in the New Building'—5 foolscap cartridge paper folios, watermark Joseph Coles 1833 (B.M. MSS. 1835–1845, Reports, Minutes etc. Zool. Dept. ff. 16–21).

56. B.M. Trustees Minutes, 1838, Sub-Committee, ff. 126–130.

57. B.M. Trustees Minutes, 1838, Sub-Committee, f. 179.

58. B.M. Trustees Minutes, 1840, GM. 1649. The Trustees Minutes, GM. 1659 of 9 May 1840, record that Children's Bonds, surrendered in 1822, were taken out of the Iron Chest and returned to him. On the same day J. E. Gray's Bonds, two at £750 each, took their place in the chest, having been provided by Col. Sidney North of Wroxham Abbey and Joseph Harrison Fryer of Whitby House, North Shields.

59. Of the Atkins family there is not much on record. Atkins sen. was an Alderman and High Sheriff of Kent (d. 1838), and his son, John Pelly Atkins, who inherited Halstead Place, Kent, from his father, was worthy to be Anna Children's husband. In 1803, John was in Lord Camden's Sevenoaks Troop and High Sheriff of Kent in 1847. In 1828, there were three daughters. H. M. Atkins, who in 1837 made an ascent of Mont Blanc as a student (Atkins, 1838), may have been a cousin. Atkins sen. is buried in the churchyard of Halstead Church, Kent; J. P. Atkins (d. 1872) and Anna also, together outside the East window.

60. British Library Add. MS. 35,057, ff. 404–407, 9 June 1847.
61. British Library MSS. No. 1881, c. 7 (63).
62. British Library Add. MS. 36,057, f. 122.
63. St George's, Bloomsbury, Register of Burials Vol. 1761–1812: 1839 7 September, Eliza Children No. 363, age 74. 1852 9 January, John George Children of Torrington Square, No. 6417, age 73. (Greater London Council, Record Office.)

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—— 1809. An Account of some Experiments, performed with a View to ascertain the most advantageous Method of constructing a Voltaic Apparatus, for the purpose of Chemical Research. *Phil. Trans. R. Soc.* **99** : 32–38.

—— 1815. An Account of some Experiments with a large Voltaic Battery. *Phil. Trans. R. Soc.* **105** : 363–374.

—— 1816. Answer to Mr Longmire's objections to Sir H. Davy's Lamp. *Ann. Phil.* **8** : 265–268.

—— 1821. An essay on chemical analysis, chiefly translated from . . . the *Traité de Chimie Elémentaire* of L. J. Thenard. . . . *Ann. Phil.* (New Ser.) **1** : 140–144.

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Portraits of George Children (1742–1818) and John George Children (1777–1852)

The known portraits of John George Children and of his father are:

1. George Children (1742–1818) of Ferox Hall, Tonbridge in 1806. Oil on canvass by A. J. Oliver R.A. (1774–1842). Donated by Mr John Charles Children to the National Portrait Gallery in 1977. Reproduced as a lithograph by M. Gauci and here as Fig. 1.
2. John George Children (1777–1852) about 1810. Oil on canvas by an unknown artist. Donated by Mr John Charles Children to the National Portrait Gallery in 1977.
3. John George Children, as Secretary of the Royal Society 1826. Pencil by Faulkner; printed by Graf and Soret. British Library Add. MS. no. 35057, f. 123.
4. John George Children, as President of the Royal Entomological Society of London, 1833–1834. Pencil by E. U. Eddis; lithographed by W. D. In the collection of the Royal Entomological Society, reproduced in Gunther (1975).
5. John George Children, as Secretary of the Royal Society 1830–1837. Oil on canvas by an unknown artist. Royal Society of London; portrait not at present available. Reproduced here as Fig. 2.

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Jean M. Ingles & Frederick C. Sawyer

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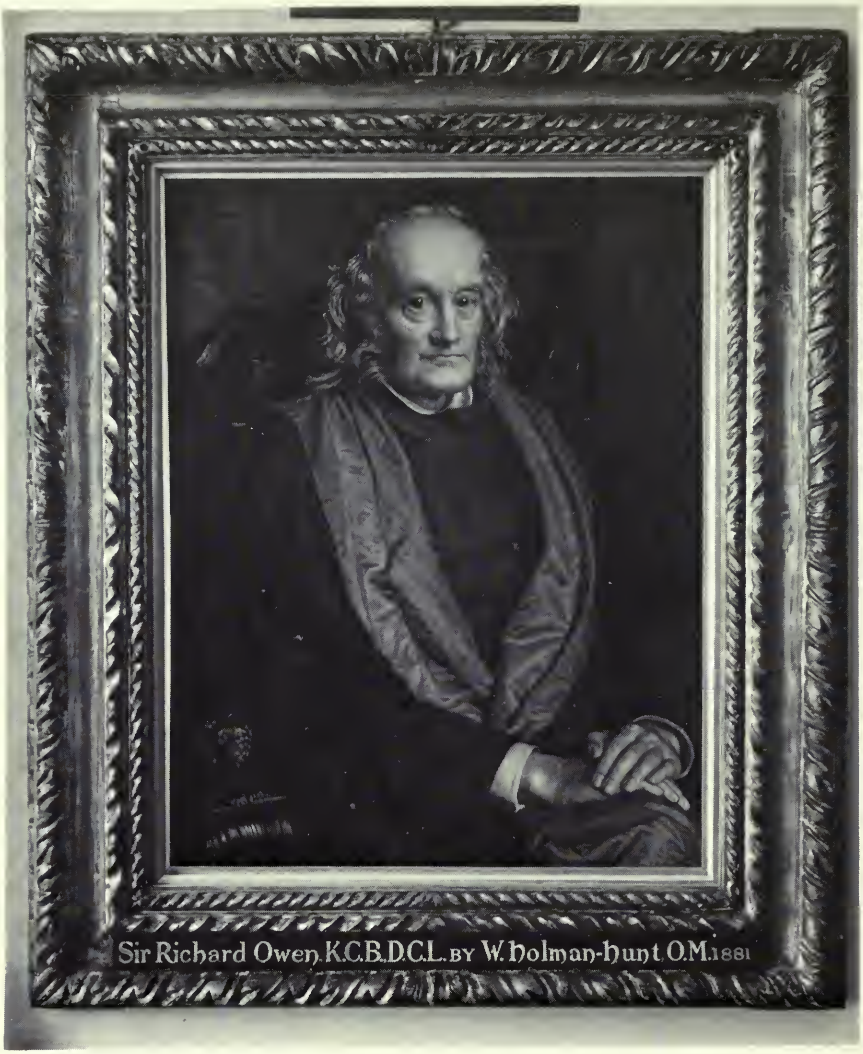
Errata

ngles & Sawyer 1979. *Bull. Br. Mus. nat. Hist.* Historical Series *6* no.5

.115 line 10 from the bottom ... 124 should be in italics
.116 line 11 for Jewel read Jewell
.136 Fol.101 following 1869 insert pp. 517-519
.138 Fol.139 delete pl.1838
.162 add Nissen, C 1953. *Die illustrierten Vogelbücher ihre Geschichte und Bibliographie*. Stuttgart: Hiersemann. 222 pp.
.164 Erxleben for Johann Christian Polycarp (1744-1777) read James (c.1830-1880)
.170 *Cervus tarandus* 275. Folio number in wrong fount. Specimen recent.


Sir Richard Owen. K.C.B. D.C.L. BY W. Holman-Hunt. O.M. 1881

Portrait in oils of Sir Richard Owen, K.C.B. now in the British Museum (Natural History) painted in 1881 by William Holman-Hunt, O.M.

A catalogue of the Richard Owen collection of Palaeontological and Zoological drawings in the British Museum (Natural History)

Jean M. Ingles
Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD
Frederick C. Sawyer

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Synopsis

A brief résumé of the life of Sir Richard Owen (1804–1892) is given with some historical and descriptive notes on the collection of drawings and the artists involved.

A systematic list of the 16 phyla and more than 500 genera represented precedes the main part of the text which is occupied by the abbreviated catalogue of 523 folios containing over 3500 drawings, many of which were used to illustrate Owen's published work. At least 110 drawings depict type material.

Three indexes are provided; the first lists the artists; the second is a comprehensive main index with the scientific names, some vernacular names and a few items entered under subject e.g. Caves; and the third brings together references to those drawings which remain partially or only tentatively identified.

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Introduction

Résumé of Owen's life

Sir Richard Owen, K.C.B., F.R.S. (1804–1892), was one of a band of eminent British natural scientists of the nineteenth century, a contemporary of Darwin, Huxley and Wallace. His biography has been detailed fully in the two volumes on his life by his grandson, the Rev Richard Owen (1894), and only a brief outline of his career is given here. Born in Lancaster on 20 July 1804, the younger son of Richard Owen (1754–1809), he was apprenticed in 1820 to a surgeon and apothecary of Lancaster where he had access to the post-mortem examinations in the county jail and became deeply interested in the study of anatomy. He matriculated at Edinburgh University in 1824 and worked at St Bartholomew's Hospital in London during 1825. In 1827 he became an assistant curator at the Hunterian Museum of the Royal College of Surgeons of England situated at Lincoln's Inn Fields in London. He was appointed Professor of Comparative Anatomy at St Bartholomew's Hospital in 1834 and in the same year was elected a Fellow of the Royal Society. In 1835 he married Caroline, daughter of William Clift, Conservator at the Hunterian Museum. On Clift's retirement Owen became sole conservator of the Hunterian Collection, continuing to live in apartments on the premises. In 1836 he became the first Hunterian Professor of Comparative Anatomy and it was as Professor Owen that he was known throughout the greater part of his life.

His career can be divided into two phases; the years 1827–1856 at the Royal College of Surgeons, during which period he became the foremost British anatomist of his day, and the second part from 1856 to 1883 covering his years of service in the British Museum. Early in 1856 some difference of opinion with the governing body of the Royal College of Surgeons of England concerning his duties in the Hunterian Museum prompted him to accept the newly created post of Superintendent of the Natural History Departments in the British Museum. Finding himself rather uncomfortably sandwiched between the Director, Antonio Panizzi, who would brook no interference with his overall conduct of the Museum, and the Keepers of the Natural History Departments who continued to run their departments in their own way, Owen devoted himself to his researches in the field of palaeontology and zoology, also to organizing a campaign for moving the natural history specimens away from Bloomsbury. As A. E. Gunther (1975) points out, Owen was quite convinced that if natural history was to be free to develop as the other sciences were at this time it must cease to be subject to an institution devoted primarily to the arts, literature, books and manuscripts which was under the direction of a Principal Librarian whose lack of interest in natural history was scarcely concealed. Owen took the opportunity in a Presidential Address to the meeting of the British Association in the summer of 1858 at Leeds to outline the principles of a National Museum of Natural History from which he never departed. He was ultimately successful and saw the removal of the collections to the new building at South Kensington during the last few years of his service. Strangely, his forward-looking efforts to remove the collections to a new and spacious building were strongly opposed in the early stages both in Parliament and by a group of eminent scientists, including Darwin and Huxley. One of his most vociferous opponents was John Edward Gray, Keeper of Zoology, from 1840 to 1875, but a century later it is apparent how right Owen was. Gray during half a century of service in the Museum had done much to build up the Zoological collections which were overflowing the available space at Bloomsbury and it seems curious that he should oppose their transfer to a site where they could be housed in comparative spaciousness. Perhaps in his declining years his judgement was clouded by the thought of removing from the congenial environment where he had spent the whole of his adult life.

Regarding Owen's part in the great controversy which followed the publication in 1859 of Darwin's *Origin of species* his great-grandson, Dr F. D. Ommanney, writes (1966) 'One of the intellectual giants of the Victorian age, he had endeared himself to the Queen by ranging himself on the side of the angels in the controversy with the odious Mr Darwin which shook society to its foundations in the middle of the last century. I have always thought that this must have been a rather cynical attitude for this great man to have taken up because, as a zoologist and anatomist of the first rank, he must have realised that Darwin and his champion, Thomas Henry Huxley, were right. However, he was a lecturer to the royal family and it was his job to lecture on not too natural history to rows of young princes and princesses.' In the manuscript of Owen's Annual Report to the Trustees for 1856 (7 January 1857), when outlining a projected exhibition in the Museum, he stated that it was 'To show how the mammalian type is progressively modified and raised from the form of fish or lizard to that of man – to illustrate the gradation by which one order merges into another.' This could be construed to support Dr Ommanney's opinion. Nevertheless, a different view is expressed by Ross (1972, chapter 7) in a discussion of Owen's beliefs and ideas on animal adaptation and modification, the background against which his convictions were formed, and his rejection of Darwin's theory of evolution.

His acquaintance with Queen Victoria may have prompted her to offer him, in 1851, a 'grace and favour' residence facing Kew Green formerly occupied by the King of Hanover. There was some delay before Owen could move into this house and it was during this period that he heard of another residence which had become vacant, Sheen Lodge[1] in Richmond Park. He was so attracted by its situation that he approached the Prince Consort to obtain from the Queen tenancy of this residence instead of the house at Kew. The request having been granted, he moved there in 1852 and remained in occupation until his death forty years later on 18 December 1892. The house abutted onto the wall of the park in the north-eastern corner, and was situated about one third of a mile to the east of East Sheen Gate. The original construction, which dated from about 1727, was built by Robert Walpole, who was at that time Ranger of the Park, for his huntsman; a building with the name 'Dog Kennel' is shown on the site in the Richardson plan of the park dated 1771. Around 1787 it was occupied by the Rt Hon William Adam and remained in the possession of the Adam family until Professor Owen took it over; Adam's Pond, immediately south of the site of the house, takes its name from this family. The lodge with its outbuildings stretched along the edge of the park for about 260 feet and some 2½ acres of land outside the park wall were purchased in 1839 to make a garden for the cottage. This land has been incorporated into Palewell Common, which borders the park wall at this point, and is now an overgrown wilderness.

Sir Richard was enchanted with the house and its surroundings, which are much the same today as they were a century ago, except that the tranquillity of this peaceful spot is now disturbed by the roar of jet airliners passing to and from London Airport a few miles to the west. Owen's daughter-in-law, Mrs Emily Owen, continued to reside in the house until her death in the autumn of 1920. Dr F. D. Ommanney lived there with his grandmother during his youth and in his book *The River Bank*, 1966, gives a graphic description of life in the house which was without any modern amenities, the long damp and cold corridors, no gas or electricity, no bathroom, and only oil lamps to dispel the gloom of winter evenings. On the night of 24 February 1944 two bombs from German aircraft fell close to the building which was badly damaged by blast and rendered uninhabitable. In October of the same year it was further damaged by fire thought to have been started by a cigarette dropped by an intruder. In ensuing years the ravages of weather made the structure so unsafe that it was decided to demolish the property; this was completed in September 1951. In March 1972 we could just trace the outline of the foundations under the turf but saplings have now been planted over the site and all traces will soon be obliterated.

It was to Sheen Lodge that Charles Davies Sherborn (1861–1942) was invited after Owen's death to sort and arrange the letters, manuscripts and drawings and to collaborate with the Rev Richard Owen in writing the biography. After the publication of the *Life of Richard Owen* in 1894 all this material was given to Sherborn, who distributed it to those likely to be interested, and it is to his generosity that the Museum is indebted for the possession of the Owen correspondence, now housed in 26 volumes, and the drawings.

Notes on the drawings

This collection which consists mainly of drawings, with comparatively few engravings and photographs, was probably started by William Clift (1775–1849). He was the last pupil of John Hunter (1728–1793) by whom he was trained to preserve, dissect, observe and record in notes and drawings. He was appointed Conservator of the Hunterian collection in 1799, his son William Home Clift became his first Assistant Curator in 1823 and Richard Owen the second in 1827.

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[1] On the ordnance survey maps of this century the building is called Sheen Cottage but Owen always addressed his letters from Sheen Lodge and it is referred to as such in this paper.

Had Clift the younger not died as the result of an accident in 1832 Owen's career might have been altogether different but in the event Clift's son was not replaced at the Museum, Owen was given more responsibility and a larger salary and after a long betrothal became Clift's son-in-law in 1835. When the Conservator retired in 1842 Richard Owen became his natural successor.

Although there are more than 3500 individual items on 523 folios in this collection of illustrations, covering a range of subjects from unicellular organisms to giant fossil reptiles and mammals, they by no means represent the entire output of work by Sir Richard Owen and his artists. Many of the drawings published by Owen in, for example, the *Transactions of the Zoological Society of London* are not to be found here, nor are they amongst the three small collections kept separately, viz. the original water colour drawings for the plates published in Owen's monograph on the Pearly Nautilus, a set of water colour drawings for the illustrations to Sir Everard Home's papers and notes on fossil Reptilia in various museums including 57 small sheets of ink and pencil sketches.

Enquiries at the Department of Prints and Drawings in the British Museum, the libraries of the Medical College, St Bartholomew's Hospital, the Royal College of Surgeons of England, the Royal Scottish Museum, Edinburgh, the Zoological Society of London and the Royal Society have brought to light no other collection. We have no knowledge of the disposal or destruction of the missing drawings.

The illustrations in the British Museum (Natural History) collection are as diverse in their form as they are in subject, being of all types; rough pencil or water colour sketches on scraps of paper or card; sketches in ink including those in letters from enquiring correspondents and superb full colour illustrations of the most delicate and detailed nature (e.g. *Limulus* dissections on Fol. 9 by one of the Scharf family and *Mytilus edulis* dissections on Fol. 12 by H. Scharf, 1842). Some were obviously commissioned for works to be published, amongst which a few were rejected (Fol. 92d), others were working drawings such as an anatomist would make in the course of his dissections, for his own use.

The drawings are varied not only in subject and technique but also in their dates which span two centuries, the earliest probably being of *Teredo* (Fol. 57) annotated 'figure d'un ver trouvé en radoubant le Triomphant. Envoyé par M. Begon le 28 Juillet 1681'. One of the latest is a photograph of a mounted solitaire skeleton (Fol. 513b) bearing a note dated 1879.

Through the generosity of Owen's executors and Dr C. D. Sherborn the collection was passed to the British Museum (Natural History) and this is recorded in the *History of the collections* . . . **1** 1904 : 44 in an entry, written by B. B. Woodward, then librarian. It stated 'the drawings have been mounted and arranged . . . but not yet catalogued'.

We do not know by whom they were arranged and mounted (it is possible that the work was done at the bindery of the British Museum, Bloomsbury), but whoever put them into their present sequence put a blue crayon number on the back of each individual sheet to indicate its position on one of the heavy backing-papers which are of a standard size, approximately 30″ × 17½″ (749 mm × 447 mm). A few unmounted drawings and engravings are included and have been given serial numbers. The folios are now housed in eight buckram and leather-covered boxes which were specially made for them in 1968, and are kept in the General Library, British Museum (Natural History).

Since their accession to the collections of the museum they have been examined by various workers including Dr C. D. Sherborn, Professor D. M. S. Watson (1886–1973), Miss Jessie Dobson, lately of the Hunterian Museum and Mr J. Mahoney of the Department of Geology and Geophysics, The University of Sydney, Australia. Annotations were added to the backing sheets by Dr Sherborn and Professor Watson also by someone unknown who added references under some of the originals of published drawings; some initialled references have also been added by one of us (J. M. I.) since 1971. It was not until 1969 that the co-author (F. C. S.), Zoological Librarian at the British Museum (Natural History) from 1935 to 1966, worked through the drawings and made the first complete preliminary list. In order to do so he first added a serial number to the top right-hand corner of each large sheet referred to here as a folio. Later individual sheets on the folios were given lower-case letters, e.g. a, b, c. Although this was not the first time some sheets had been given numbers it was the first time the whole collection had been systematically numbered from beginning to end.

In 1976 an additional folded sheet (Fol. 523) was found in the Palaeontology Library and this was added to those in the boxes.

In 1971 we started compiling the catalogue as an occasional spare-time occupation. At that time neither of us appreciated the magnitude of the task and the volume of work involved in naming and cataloguing this collection.

Whilst some of the drawings were already identified completely, others had a vague label, e.g. an abbreviated word such as 'Poik.' standing for Poikilopleuron [*Poekilopleuron*] and many (about one third) had nothing whatsoever to indicate their identity. We have consulted many specialists (see Acknowledgements) and books in an endeavour to get accurate identifications, names in current usage and in establishing the location of published figures. For the interpretation of information received we are responsible.

Notes on the artists

As will be seen from the index to artists (p. 164–165) the main contributor to the collection was Richard Owen himself, the earliest of his dated drawings being 1823, but William Clift, his son William Home Clift and professional artists are represented, e.g. Joseph Dinkel and the Scharf family of whom one member was George Scharf (1788–1860) father of Henry and George (1820–1895) who later became Sir George and Director of the National Portrait Gallery. (So far we have been unable to undertake the task of establishing which of the two people named George Scharf executed the various items listed under that name in the index but their dates have been added and may serve to remind readers that two people are involved.) Other famous names include J. Erxleben, Gideon Mantell (1790–1852), Sydney Parkinson (1745–1771), who accompanied Captain James Cook on his first world voyage (1768–1771), and Josef Wolf (1820–1899).

Many of the 147 people who are listed because they drew specimens were correspondents, including interested amateurs, who sent material and drawings to Richard Owen. Sometimes they were requesting information, but at other times they simply thought the famous man would be interested in a particular specimen.

There are entries in the index to artists under initial letters only. These have been taken from drawings but attempts to identify the full name have failed. Under C. there are probably some drawings of the Clifts, but this is conjecture. Where the initials or name of an artist have been put in square brackets in the text it is because either (1) the name or initials are not clearly decipherable or (2) comparison of the unsigned work with signed work leads us to believe firmly that it is identifiable with a particular artist, e.g. [R. Hills] Fol. 306. Although the folio is unsigned, R. Hills' technique is unmistakeable – further evidence for its being his work lies in the shorthand notes which have been made about the drawings, in characteristic style.

Notes on the catalogue entries

The original entries for the catalogue have been typed on to four-post binder slips (5″ × 3″) of which there are about 1360, occupying eight binder covers – one for each box of drawings.

Each entry is set out as follows and the figures at the top left indicate that this one refers to folio 56 for which this is the first sheet of a total of three.

56 (1)^3 MOLLUSCA – BIVALVIA – PHOLADOMYOIDA
(a, b) *Pholadomya* [*candida*]
Morphology of animal removed from shell
(a) with detail of mantle
Three water colour drawings
H. Scharf del. 1839
Annotated – Original drawings *Pholadomya* . . .

Manuscript description attached to sheet begins –
Fig. 1.
[Mention is made of these drawings on p. 47 in
Runnegar, B. Anatomy of *Pholadomya candida*
(Bivalvia) and the origin of the Pholadomyidae.
Proc. malac. Soc. Lond. **40**, 1972 : 45–58.]

56(2)[3] MOLLUSCA – GASTROPODA – MESOGASTROPODA
(c) *Calypeopsis* [*Calyptraea byronensis*]
Shell, dorsal and ventral views and six dissections
Eight water colour and pen & ink drawings
R. Owen del.
Published – *Trans. zool. Soc. Lond.* **1** 1835 pl. 30, figs. 1–7.

Limitations of space have necessarily imposed a format with a high degree of abbreviation and the omission of some material which, however, will be available in the unabridged catalogue in the General Library of the British Museum (Natural History).

The printed entries for each drawing comprise generic and specific names, an abbreviated description of the part illustrated, the type of drawing, e.g. pencil, water colour, etc., name of artist, a reference to the work in which it was published, location of the specimen delineated, its status as type-material where appropriate and the abbreviation Annot. to indicate when there are annotations on the drawing: these quotations are shown in the unabridged catalogue.

Notes on the scientific names

1 The name (if any) written by Owen on the original drawing is placed at the beginning of the entry, without brackets.
2 If the name with which a drawing was published differs from (1) it is put into square brackets and the reference to the published work will be found below in the entry for that folio.
3 The names given to the specimen by Owen and his contemporaries are often now in synonymy or have fallen into disuse. As far as possible we have updated the nomenclature, and the modern version always appears as the last of the scientific names listed.

Examples

Fol. 210 (see p. 143) where the names appear as follows

$$\underbrace{\textit{Chelydra serpentina}}_{\text{Labelled by Owen}} \quad \underbrace{[\textit{Chelys fimbriata}}_{\text{Published as}} \quad \underbrace{[\textit{Chelus fimbriatus}]]}_{\text{Current name}}$$

Alternatively Fol. 274(c) (see p. 145):

[*Rhinolophus* [*Hipposideros*] *larvatus*]

This format indicates that the drawing was unlabelled by Owen. It was published as *Rhinolophus larvatus* but is currently regarded as *Hipposideros larvatus*. It was to save space and repetition that we decided upon the use of this format and we believe that workers will readily understand the nomenclatural changes indicated.

Notes on British Museum (Natural History) specimens

Specimens known or reported to be in these collections have an asterisk following the scientific name and the Museum registration numbers are given for many specimens. Most have been checked against specimens or in the register. Those in square brackets have not been confirmed.

Example

Fol. 158 (a) †[*Megalosaurus dunkeri* [*M. oweni*]]*
etc.
[B.M.(N.H.) No. 2680]

The prefix B.M.(N.H.) is represented by * in the abbreviated catalogue.

Notes on the systematic list of taxa represented

A guide to current names of the taxa represented in the drawings is given on pp. 116–128.

Taxa above the generic level are arranged systematically. Genera are listed alphabetically.

This list is not intended to be used as a table of classification for the whole of the animal kingdom but as a guide to the contents of this work. For those who are not familiar with zoology it provides a guide to groups into which particular genera are classified.

Useful levels of classification vary. In the recent Mammalia it has been felt necessary to provide the ordinal, generic and sometimes family names. In some other groups it has been considered best to give information at a different level.

We have taken advice from specialists over individual phyla and in the interests of brevity have not attempted to include unnecessary names merely for the sake of uniformity.

References to works used in arranging this list are to be found on pp. 160–163.

Notes on the references

The list of references, pp. 160–163, includes only those works consulted in connection with history, nomenclature and taxonomy. It does not include references concerned with the location of published Owen Collection drawings which are incorporated within the catalogue entries.

Some drawings have been published more than once. In such cases only the earliest publication of which we are aware is cited in the abbreviated catalogue. Later references will be found in the unabridged catalogue in the General Library of the British Museum (Natural History).

Notes on the indexes

We feel that the entries would have been too clumsy if the folio sub-division letters had been added, especially in those cases where long series of numbers are involved. It is hoped that readers will quickly find the item they seek by scanning the text under the relevant folio number.

Index of artists (*p. 164–165*)

Artists are listed by name or initials together with the numbers of the folios on which their works appear. No attempt has been made to separate entries for recent and fossil specimens in this index.

General index (*pp. 166–193*)

This contains all the generic and specific names which appear in the catalogue, whether or not they are currently valid, followed by the numbers of the folios on which they appear.

Those names which appear in the unabridged catalogue (available in the General Library of the British Museum (Natural History)) but which do NOT appear in this text are listed with their ital folio numbers in parentheses, e.g. MAMMALIA 124, (2, 3, 7, etc.).

Some vernacular names have been included in the index but we have not attempted to make up names neither have we sought out common names for such specimens as little known invertebrates nor for the majority of the fossils, very few of which have vernacular names applied to them.

Folio numbers in bold type in the general index refer to illustrations of fossils.

Page numbers are in italics.

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Systematic list of taxa represented

† indicates fossil

- Phylum PROTOZOA
  - Class PHYTOMASTIGOPHOREA
    - Incertae sedis Genus *Microglena* (*monadina*)
      - Genus *Distigma*
        - *Eudorina*
        - *Euglena*
        - *Eutreptia*
        - *Lagenella*
        - *Microglena* (*punctifera*)
        - *Phacus*
        - *Trachelomonas*
        - *Ulothrix*
  - Class CILIATEA
    - Genus *Ophryoglena*
- Phylum COELENTERATA
  - Class HYDROZOA
    - Genus *Physalia*
  - Class ANTHOZOA
    - Genus *Isis* (Gorgonian, sea-fan)
      - *Tealia* (Sea-anemone)
- Phylum CTENOPHORA (Comb jellies)
  - Genus *Beroe*
- Phylum PLATYHELMINTHES (Flat worms)
  - Class TREMATODA
    - Genus *Hirudinella*
      - unidentified liver fluke
  - Class CESTODA
    - Genus *Anoplotaenia*
      - *Dasyurotaenia*
      - *Moniezia*
      - *Taenia*
      - unidentified (Cyclophyllidea)

Phylum NEMERTINEA
    Genus *Caninimula*

Phylum ASCHELMINTHES
  Class NEMATODA
    Genus *Breinlia*
        Capillaria
        Dioctophyme
        Dujardinascaris
        Trichinella

Phylum BRACHIOPODA
  Class INARTICULATA
    Genus *Discinisca*†
        Glottidia†
        Lingula†
        Orbicula†
  Class ARTICULATA
   Incertae sedis Superfamily THECIDEACEA Genus *Lacazella*†
    Genus *Hemithiris*†
        Magellania†
        Terebratella†

Phylum MOLLUSCA
  Class POLYPLACOPHORA
    Genus *Chaetopleura*
  Class GASTROPODA (Snails, slugs, limpets, whelks, nudibranchs)
    Genus *Buccinum*
        Calyptraea
        Carinaria
        Conus
        Cypraea
        Doris
        Lambis
        Pterotrachea
        Terebellum
  Class BIVALVIA
    Genus *Clavagella* (*Bryopa*)
        Hippurites
        Kuphus
        Musculus
        Mytilus
        Pecten
        Pholadomya
        Spondylus
        Teredo
        Uperotus
  Class CEPHALOPODA
   Incertae sedis Genus *Loligopsis*
    Genus *Architeuthis*
        Argonauta
        Cenoceras†
        Cranchia
        Enoploteuthis
        Eutrephoceras†
        Harpoceras†
        Hildoceras†
        Lytoceras†
        Nautilus
        Octopus
        Octopus (*Tritaxeopus*)

- Genus *Ommastrephes*
    - *Onychoteuthis*
    - *Onykia*
    - *Oppelia*†
    - *Rossia*
    - *Sepia*
    - *Sepietta*
    - *Sepiola*
    - *Sepioteuthis*
    - *Spirula*
    - *Tremoctopus*
    - unidentified (Ammonoidea†)
    - unidentified (Belemnitida†)

Phylum SIPUNCULA
- Genus *Sipunculus*

Phylum ECHIURA
- Genus unidentified (Echiuroinea)

Phylum ANNELIDA
- Incertae sedis Genus *Helminthodes*†
- Class POLYCHAETA
    - Genus *Arenicola*
        - *Nephtys*
        - *Nereis*
        - unidentified (Alciopidae)
        - unidentified (Nereidae)
        - unidentified (Phyllodocidae)
- Class OLIGOCHAETA
    - Genus unidentified (Lumbricidae)

Phylum ARTHROPODA
- Class TRILOBITA (Trilobites)
    - Genus *Chasmops*†
- Class MEROSTOMATA
    - Genus *Belinurus*†
        - *Limulus* (King crab, horse-shoe crab)
- Class ARACHNIDA
    - Genus unidentified (Scorpiones)
- Class CRUSTACEA
    - Subclass COPEPODA
        - Genus *Acanthochondria*
            - *Chondracanthodes*
            - *Chondracanthus*
            - *Clavella*
            - *Diocus*
            - *Kroyeria*
            - *Lepeophtheirus*
            - *Lernaeocera*
            - *Lernaeopoda*
            - *Peniculus*
            - *Pennella*
    - Subclass MALACOSTRACA
        - Genus ? *Acturus*
            - *Calcinus*
            - *Enoploclytia*†
            - *Eualis*
            - *Hemioniscus*
            - *Heptacarpus*
            - *Labidochirus*
            - *Lebbeus*

        Genus *Macrophthalmus*
                Metagrapsus
                Petrolisthes
                Phronima
                Pseudosquilla
                Sclerocrangon
                Spirontocaris
                unidentified (Anomura)
                unidentified (Parastacidae)
    Class DIPLOPODA (Millipedes)
        Genus *Julus*
                Polydesmus
    Class CHILOPODA (Centipedes)
        Genus *Scutigera*
    Class INSECTA
        Genus *Borocera*
                Goliathus
                Periplaneta
                unidentified (Lepidoptera)

Phylum PENTASTOMIDA (Tongue worms)
        Genus *Linguatula*

Phylum CHAETOGNATHA (Arrow worms)
        Genus unidentified

Phylum ECHINODERMATA
    Class ECHINOIDEA
        Genus *Heterocentrotus*

    Class HOLOTHURIOIDEA (Sea cucumbers)
        Genus unidentified (Cucumariidae)

Phylum CHORDATA
    Subphylum UROCHORDATA (Tunicates)
            Genus *Dagysa*
                    Pegea
                    Salpa
                    Thetys

    Subphylum CEPHALOCHORDATA
            Genus *Branchiostoma* (Lancelet)

    Subphylum VERTEBRATA
          Incertae sedis Genus *Oreodus*†
      Class AGNATHA
            Genus *Lampetra* (Lampreys)

      Class ACANTHODII
            Genus *Gyracanthus*†

      Class CHONDRICHTHYES
          Subclass ELASMOBRANCHII (Sharks)
            Genus *Acrodus*†
                    Alopias
                    Carcharhinus
                    Carcharodon
                    Cetorhinus
                    Lamna
                    Myliobatis
                    Odontaspis
                    Pristis
                    Ptychodus†
                    Sphyrna
                    Squalus

Subclass HOLOCEPHALI
- Genus *Callopristodus*†
  - *Cochliodus*†
  - *Deltodus*†
  - *Deltoptychius*†
  - *Edestus*†
  - *Platyxystrodus*†
  - *Tomodus*†

Class OSTEICHTHYES (bony fish)

Subclass ACTINOPTERYGII
- Genus *Acipenser*
  - *Bagre*
  - *Caturus*†
  - *Cylindracanthus*†
  - *Diodon*
  - *Eocoelopoma*†
  - *Esox*
  - *Exocoetus*
  - *Gadus*
  - *Gobio*
  - *Gymnocephalus*
  - *Hippocampus*
  - *Lepidotes*†
  - *Lepisosteus*
  - *Leuciscus*
  - *Melanogrammus*
  - *Merlangius*
  - *Pleuronectes*
  - *Prosauropsis*†
  - *Salmo*
  - *Sargus*
  - *Solea*
  - *Sphyraenodus*†
  - *Stereodus*†
  - *Xiphias*
  - *Zeus*
  - unidentified (Carangidae)
  - unidentified (Perciformes)
  - unidentified (Scombroidei)

Subclass CROSSOPTERYGII
- Genus *Dendrodus*†
  - *Megalichthys*†
  - *Rhizodopsis*†
  - *Rhizodus*†

Subclass DIPNOI
- Genus *Protopterus*
  - *Sagenodus*†

Class AMPHIBIA (Frogs, toads, newts, salamanders)
- Genus *Cryptobranchus*
  - *Mastodonsaurus*†
  - *Necturus*
  - *Rana*
  - *Rhytidosteus*†
  - *Siren*
  - *Triturus*
  - unidentified (Anura)
  - unidentified (Caudata)

- Class REPTILIA
  - Incertae sedis Genera *Cylindricodon*† & *Rysosteus*†
  - unidentified (Archosaurian†)
  - Order COTYLOSAURIA
    - Genus *Leptopleuron*†
  - Order TESTUDINATA (Tortoises, terrapins & turtles)
    - Genus *Chelonia*
      - *Chelus*
      - *Chitra*
      - *Emys*
      - *Eosphargis*†
      - *Eretmochelys*
      - *Lytoloma*†
      - *Meiolania*†
      - *Palaeochelys*†
      - *Platychelys*†
      - *Tretosternon*†
      - unidentified (Chelonian†)
      - unidentified (Emydidae†)
  - Order SQUAMATA (Lizards & snakes)
    - Genus *Ceratophora*
      - *Chamaeleo*
      - *Coluber*
      - *Coniasaurus*†
      - *Dolichosaurus*†
      - *Iguana*
      - *Lacerta*
      - *Liodon*†
      - *Macellodus*†
      - *Megalania*†
      - *Moloch*
      - *Mosasaurus*†
      - *Phrynosoma*
      - *Python*
      - *Tupinambis*
      - *Varanus*
      - unidentified (Mosasauridae)
  - Order RHYNCHOCEPHALIA
    - Genus *Rhynchosaurus*†
  - Order THECODONTIA
    - Genus *Phytosaurus*†
      - unidentified†
  - Order CROCODILIA (Crocodiles, gharials, alligators)
    - Genus *Aeolodon*†
      - *Alligator*
      - *Crocodylus*
      - *Crocodylus* (*Suchosaurus*)†
      - *Diplocynodon*†
      - *Gavialis*
      - *Goniopholis*†
      - *Oweniasuchus*†
      - *Saurodesmus*†
      - *Steneosaurus*†
      - *Teleosaurus*†
      - *Theriosuchus*†
      - unidentified
  - Order PTEROSAURIA
    - Genus *Dimorphodon*†
      - *Pterodactylus*†

Genus *Rhamphorhynchus*†
unidentified†
Order Saurischia
Genus *Cardiodon*†
Cetiosaurus†
Eustreptospondylus†
Megalosaurus†
Pelorosaurus†
'*Streptospondylus*'†
Thecospondylus†
unidentified†
Order Ornithischia
Genus *Hylaeosaurus*†
Iguanodon†
Omosaurus†
Protorosaurus†
Saurechinodon†
Scelidosaurus†
unidentified†
Order Sauropterygia
Genus *Plesiosaurus*†
Pliosaurus†
Polyptychodon†
Thaumatosaurus†
unidentified Plesiosaurians†
unidentified Pliosaurian†
Order Placodontia
Genus *Cyamodus*†
Placodus†
Order Ichthyosauria
Genus *Ichthyosaurus*†
Order Therapsida
Genus *Dicynodon*†
Dicynodon (*Ptychognathus*)†
Lystrosaurus†
Mormorosaurus†
Oudenodon†
Stereognathus†

[Note: *Haramiya*† & *Hypsiprymnopsis*† are included in the Mammalia.]

Class AVES
Order Archaeopterygiformes
Genus *Archaeopteryx*†
Order Struthioniformes (Ostriches)
Genus *Struthio*
Order Rheiformes (Rheas)
Genus *Rhea*
Order Casuariiformes (Cassowaries, emus)
Genus *Casuarius*
Dromaius
Dromornis
Order Dinornithiformes (Moas)
Genus *Anomalopteryx*†
Dinornis†
Emeus†
Euryapteryx†
Megalapteryx†
unidentified†

- Order APTERYGIFORMES (Kiwis)
  - Genus *Apteryx*
- Order AEPYORNITHIFORMES (Elephant bird)
  - Genus *Aepyornis*†
- Order SPHENISCIFORMES (Penguins)
  - Genus *Aptenodytes*
- Order GAVIIFORMES (Divers, loons)
  - Genus *Gavia*
- Order PELECANIFORMES (Pelicans)
  - Genus *Pelecanus*
- Order ODONTOPTERYGIFORMES
  - Genus *Odontopteryx*†
- Order CICONIIFORMES (Storks)
  - Genus *Leptoptilos*
    - *Lithornis*†
- Order ANSERIFORMES (Ducks, geese)
  - Genus *Anas*
    - *Anser*
    - *Cnemiornis*†
- Order FALCONIFORMES (Hawks, eagles, falcons, etc.)
  - Genus *Aquila* (inc. *Uroaëtus*)
    - *Circus*
    - *Falco*
    - *Harpagornis*†
    - *Neophron*
    - *Polyharpagornis*†
    - *Vultur*
- Order GALLIFORMES (Domestic & guinea fowl)
  - Genus *Gallus*
    - *Numida*
- Order GRUIFORMES (Rails)
  - Genus *Aptornis*†
    - *Porphyrio* (incl. *Notornis*)
    - *Rallus*
- Order CHARADRIIFORMES (Gulls & waders)
  - Genus *Larus*
    - *Numenius*
- Order COLUMBIFORMES (Pigeons, dodo & solitaires)
  - Genus *Columba*
    - *Pezophaps*†
    - *Raphus*†
- Order PSITTACIFORMES
  - Genus *Calyptorhynchus*
    - unidentified Parrot
- Order CAPRIMULGIFORMES
  - Genus *Batrachostomus*
    - unidentified Nightjar
- Order APODIFORMES (Swifts)
  - Genus *Apus*
- Order CORACIIFORMES (Kingfishers)
  - Genus *Halcyornis*†
    - *Lacedo*
    - unidentified Kingfisher
- Order PICIFORMES (Woodpeckers)
  - Genus *Ramphastos*
    - unidentified Woodpecker
- Order PASSERIFORMES (Crows, broad bills & babblers)
  - Genus *Corvus*
    - *Eurylaimus*

- Genus *Pomatorhinus*
  - unidentified
- Order unidentified
  - Genus unidentified

Class MAMMALIA

- Incertae sedis Genus *Leptolestes*†
- Family Haramiyidae†
  - Genus *Haramiya*†
  - *Hypsiprymnopsis*†
- Order MONOTREMATA (Platypus, spiny anteaters)
  - Genus '*Echidna*'†
  - *Ornithorhynchus*
  - *Tachyglossus*
- Order MULTITUBERCULATA
  - Genus *Bolodon*†
  - *Ctenacodon*†
  - *Plagiaulax*†
- Order TRICONODONTA
  - Genus *Amphilestes*†
  - *Phascolotherium*†
  - *Triconodon*†
  - *Trioracodon*†
- Order PANTOTHERIA
  - Genus *Amblotherium*†
  - *Amphitherium*†
  - Dryolestidae† – genus unidentified
  - *Kurtodon*†
  - *Peramus*†
  - *Peraspalax*†
  - *Phascolestes*†
- Order SYMMETRODONTA
  - Genus *Spalacotherium*†
- Order MARSUPIALIA (Kangaroos, wallabies, pouched mice, koalas, opossums, wombats, thylacine, Tasmanian devil)
  - Genus *Bettongia*
  - *Cercartetus*
  - Didelphidae – genus unidentified
  - *Didelphis*
  - *Diprotodon*†
  - *Hypsiprymnodon*
  - *Isoodon*
  - *Lasiorhinus*
  - Macropodidae – genus unidentified
  - *Macropus*
  - *Macrotis*
  - *Myrmecobius*
  - *Nototherium*†
  - *Palorchestes*†
  - *Perameles*
  - *Petaurus*
  - *Phascogale*
  - *Phascolarctos*
  - *Phascolonus*†
  - *Philander*
  - *Potorous*
  - *Procoptodon*†
  - *Protemnodon*†
  - *Sarcophilus*

Genus *Sceparnodon*†
- *Sthenurus*†
- *Thylacinus*
- *Thylacoleo*†
- *Trichosurus*
- Vombatidae – genus unidentified
- *Vombatus*
- *Zygomaturus*†
- unidentified

Order Deltatheridia
Genus *Hyaenodon*†
- *Solenodon*
- *Tenrec*

Order Insectivora (Desmans, shrews, moles & tree-shrews)
Genus *Condylura*
- *Desmana*
- Soricidae – genus unidentified
- *Talpa*
- *Tupaia*

Order Chiroptera (Bats)
Genus *Cheiromeles*
- *Hipposideros*
- *Macroglossus*
- *Pteropus*
- *Rhinolophus*
- *Tadarida* (*Chaerephon*)

Order Primates (Lemurs, monkeys, apes, man)
Genus *Ateles*
- *Cercocebus*
- Colobinae – genus unidentified
- *Daubentonia*
- *Gorilla*
- Hominoidea – genus unidentified
- *Homo*
- *Macaca*
- *Pan*
- *Pongo*
- *Symphalangus*

Order Edentata (Sloths & armadillos)
Genus *Bradypus*
- *Chlamyphorus*
- *Choloepus*
- *Cyclopes*
- Dasypodidae – genus unidentified
- *Dasypus*
- *Doedicurus*†
- *Euphractus*
- *Glyptodon*†
- *Hoplophorus*†
- *Megalonyx*†
- *Megatherium*†
- *Mylodon*†
- *Myrmecophaga*
- *Panochthus*†
- *Priodontes*
- *Scelidotherium*†
- *Tolypeutes*

Order LAGOMORPHA
  Genus *Oryctolagus* (Rabbits)

Order RODENTIA (Beavers, capybara, porcupines, squirrels, rats, etc.)
  Genus *Bandicota*
    Callosciurus
    Capromys
    Castor
    Dasyproctidae – genus unidentified
    Dinomys
    Gerbillus
    Hydrochoerus
    Hystrix
    Jaculus
    Lagidium
    Marmota
    Mastacomys
    Rattus
    Spermophilus
    Trogontherium†
    unidentified

Order CETACEA (Whales, dolphins)
  Genus *Balaena*
    Balaenidae – genus unidentified
    Balaenodon†
    Balaenoptera
    Basilosaurus†
    Caperea
    Delphinus
    Grampus
    Kogia
    Megaptera
    Monodon
    Orcaella
    Phocaena
    Physeter
    Platanista
    Pseudorca
    Tursiops
    Ziphius
    unidentified

Order CARNIVORA (Dogs, cats, otters, badgers, bears, etc.)
  Genus *Canis*
    Crocuta
    Enhydra
    Felis
    Herpestes
    Hyaena
    Meles
    Mydaus
    Panthera
    Selenarctos
    Smilodon†
    Suricata
    Thalarctos
    Ursus
    Viverricula

Order PINNIPEDIA (Seals & walrus)
  Genus *Halichoerus*
    Hydrurga

  - Genus *Odobenus*
    - *Phoca*
- Order Notoungulata
  - Genus *Toxodon*†
- Order Tubulidentata (Aardvark)
  - Genus *Orycteropus*
- Order Proboscidea (Mammoths, mastodons, elephants)
  - Genus *Anancus*†
    - *Deinotherium*†
    - Elephantidae – genus unidentified
    - *Elephas*
    - *Loxodonta*
    - *Mammut*† (American mastodon)
    - *Mammuthus*† (Mammoth)
    - '*Mastodon*'† – genus unidentified
    - *Stegodon*†
    - *Stegolophodon*†
    - *Tetralophodon*†
    - unidentified†
- Order Sirenia (Dugongs, sea cows, manatees)
  - Genus *Dugong*
    - *Eotheroides*†
    - *Halitherium*†
    - *Prorastomus*†
    - *Trichechus*
- Order Perissodactyla (Odd-toed ungulates: horses, rhinos, tapirs)
  - Genus *Aceratherium*†
    - *Ceratotherium*
    - *Coelodonta*†
    - *Dicerorhinus*
    - *Elasmotherium*†
    - *Equus*
    - *Hyracotherium*†
    - *Lophiodon*†
    - *Palaeotherium*†
    - *Rhinoceros*
    - *Tapirus*
- Order Artiodactyla (Even-toed ungulates: antelopes, cattle, deer, giraffes, hippos, llamas, pigs, sheep)
  - Genus *Alcelaphus*
    - *Alces*
    - *Anthracotherium*†
    - *Antilocapra*
    - *Bison*
    - *Bos*
    - *Bothriodon*†
    - Bovidae – genus unidentified
    - *Camelus*
    - *Cervus*
    - *Connochaetes*
    - *Dichodon*†
    - *Eucladoceros*†
    - *Euctenoceros*†
    - *Gazella*
    - *Giraffa*
    - *Hippohyus*†
    - *Hippopotamus*
    - *Hyotherium*†

Genus *Kobus*
- *Lama*
- *Megaloceros*†
- *Merycopotamus*†
- *Microstonyx*†
- *Moschus*
- *Muntiacus*
- *Oryx*
- *Ovibos*
- *Ovis*
- *Rangifer*
- *Sus*
- *Tetracerus*
- unidentified ruminant

Abbreviated catalogue

Abbreviations

A.M.S. = Australian Museum Sydney
Anat. = anatomy
Annot. = annotated
ant. = anterior
c. = coloured
d. = drawing
del. = delineated
diss. = dissected or dissection
dors. = dorsal view
engr. = engraving
f. = figure
Fig. = Figured (in publication)
Fol. = folio
G.S. = George Scharf (father 1788–1860: son 1820–1895)
H.S. = H. Scharf
i. = ink
l. = left
lat. = lateral view
l.c. = *loco citato*
m. = mandible
occ. = occlusal view
p. = pencil
P: = published
pal. = palatal view
pl. = plate
post. = posterior
r. = right
R.O. = Richard Owen
s. = sepia
sk. = skull
skel. = skeleton
unident. = unidentified
vent. = ventral view
w.d. = watercolour drawing
W.C. = William Clift
† = fossil
* = B.M.(N.H.) specimen
♂ = male
♀ = female

Sequence of scientific names see p. 114.

Catalogue

Folio

1 *Terebratula* [*Magellania*] *flavescens* 3 diss.: proof engr. P: Owen, R. On the anatomy of the Terebratula *in* Davidson, T. *Brit. Fossil Brachiopoda* **1** *Palaeontogr. Soc.* (*Monogr.*) 1851–54 **a** pl.2 f.1,2 **b** pl.1 f.1–4 *Lingula anatina* diss.: 11 f. on proof engr. [R.O. & H.S. del.] P: *l.c.* **a** pl.2 f.1,2 **b** pl.1 f.5–7. For orig. c.d. see Fols 10 & 11

2 **a** † *Balaenodon* tooth, part of transverse section mag. × 8: 1 varnished w.d. S. W. Leonard del. Annot. **b** † *Elephas indicus* [*maximus*] 5th lower molar, lat. & occ.: 3 pencil rubbings with w. wash P. O. Hutchinson del. Annot.

3 **a,f,h** † *Castor* [*Trogontherium cuvieri**] femur fragment, distal end: 3 views, 3 s.d. Annot. *No. 40979 **b** † [*Nototherium*] lower jaw, l. lat.: 1 photo. **c** † [*Mastodon latidens**] teeth, occ.: 2 photos *No. 40678. *Homo sapiens* from Australia **d** lower jaw, occ. **e** upper jaw, pal. **g** sk. & m. l. lat.: 3 photos. Annot.

4 † [Plesiosaurian] skel. fragments including teeth: 7 p. & wash d. Annot.

5 Block makers pulls of Fol. **6**

6 *Sepia palmata* [*S. apama*] whole animal & shell **a** vent. **b** dors.: 4 w.d. P: *Trans. zool. Soc. Lond.* **11** 1881 pl.24,25. Annot. HOLOTYPE of *S. palmata*

7 **a** *Ornithorhynchus anatinus* ♂ organs, diss.: 1 wash d. ? Original for figure in Jones, T. Rymer *Outline of organization of animal kingdom* Lond. 1841 f.325 **b** [*Terebratula* [*Magellania*] *flavescens*] alimentary canal: 1 engr. Annot. P: Owen, R. On the anatomy . . . Terebratula *in* Davidson, T. *Brit. fossil Brachiopoda* **1** *Palaeontogr. Soc.* (*Monogr.*) 1851–54 pl.1 f.4. For orig. c.d. see Fol. **10 j** **c** *Echidna hystrix* [*Tachyglossus aculeatus*] ♂ organs diss.: 1 wash d. **d** [*Lacazella* sp.] late larval stage: 1 engr. Annot. **e,g** *Dromiceius* [*Dromaius*] embryo, vent. & dors.: 4 p.d. R.O. del. **f** [? *Lacazella* sp.] ovary: 1 engr. H. Lacaze-Duthiers del. P: *Annls Sci. nat. Zool.* **15** 1861 pl.3f.8 **h** *Lingula anatina* alimentary canal, dors.: 1 engr. P: *l.c.* for **7b** pl.1 f.6

8 *a* [*Terebratula* [*Magellania*] *flavescens*] 1 engr? Scharf. For orig. c.d. see Fol. **10 c** & **11 e** **b** [*Orbicula* [*Discinisca*] *lamellosa*] soft parts diss.: 4 engr. Annot. P: *Trans. zool. Soc. Lond.* **1** 1835 pl.23 f.5–8 **c** *Orbicula* [*Lingula audebardii*] whole animal: 1 engr. P: *l.c.* f.14 **d** [*Magellania flavescens*] diss.: 1 engr. For original c.d. see Fol. **10 b** **e** [*Orbicula lamellosa*] superior mantle-lobe, injected, magnified part: 1 engr. Annot. P: *l.c.* pl.23 f.11 **f** [*Lingula anatina*] diss. of muscles: 1 engr.

Folio

Annot. **g** [*Lingula anatina*] diss. & embryos: 1 engr. (4 figs) Annot. **h** [*Orbicula lamellosa*] branchial tentacles and edge of mantle, magnified part: 2 engr. P: *l.c.* pl.23 f.12,13 [*Lacazella mediterranea*] **i** specimen open, post. **j** stylized lat.: 2 engr. [H. Lacaze-Duthiers del.] P: *Annls Sci. nat. Zool.* **15** 1861 pl.1 f.3,7

9 *Limulus* [*polyphemus*] diss. to show **a** nervous system, dors. **b** stomach **c** compound eye **d** alimentary canal & nervous system **e** nervous system: 5 w.d. [H.] Scharf del. pl.3; in colour Annot. See also Fol. **72 b,d, e** P: Owen, R. *Anatomy of the king crab* . . . London, 1873 pl.2 f2,1.

10 **a–j** *Terebratula* [*Magellania*] *flavescens* series of diss.: 10 c.d. P: *Trans. zool. Soc. Lond.* **1** 1835 pl.23 f.5–8

11 **a–g** *Lingula anatina* anatomy **a,g** alimentary canal, muscles & liver **b** reproductive organs **c** embryo development, 8 views **d** muscles & nerves **e** nerves of mantle **f** circulatory system: 7 c.d. Annot. P: Owen, R. Anat. of Terebratula *in* Davidson, T. *Brit. fossil Brachiopoda* **1** *Palaeontogr. Soc.* (*Monogr.*) 1851–54 pl.2 & 3. See also Fol. **1 a,b** & Fol. **7 h**

12 **a–c, e–h** *Mytilus edulis* **d** *Mytilus* nervous system, stages in diss.: 9 c.d. H.S. del. **e** Fig: *Encyclopaedia Britannica* Edinburgh 8th ed 1853–60 **15** p.345 f.18

13 **a** Sturgeon [? *Acipenser*, *Gadus morhua*, *Melanogrammus aeglefinus*, *Xiphias gladius*, *Pleuronectes platessa*, *Solea solea*, *Gobio gobio*, *Leuciscus leuciscus*,] saccular otoliths, 2 views of each: 28 w.d. Annot. **b** [Genera unident.] stapes: 25 w.d. Annot. **c** *Ornithorhynchus*, *Talpa*, *Homo*, *Marmota*, Cetacea [unident.], *Panthera tigris*, *Odobenus*, *Equus*, *Sus*, *Anser*, Snake [unident.]: stapes of all the above: 12 i. outline d. Annot. ? prelim. d. for *Phil. Trans. R. Soc.* **95** 1805 pl.4 **d** [Vertebrata, genera unident.]: stapes & otoliths: 5 w.d. Annot. **e** Perciformes [unident.] **lower row** Carangidae **upper row** [Vertebrates unident.] otoliths of left ear: 13 w.d. Annot. **f** *Homo sapiens* ear, diss. to show internal structure: 2 w.d.

14 [*Homo sapiens*] **a** cavity of tympanum – 6th month **b** Labyrinth, cochlea & semicircular canals of 4th month foetus: 2 w.d.

15 **a–g** [*Homo sapiens*] sk. & auditory organs, diss.: 10 w.d. **f** W. W. Cooper del. Annot.

16 **a** Museum Geologicum Pragense, front view: 1 photo. **b** Aston Aquarium, nr Birmingham, interior: 1 photo. Annot.

17 Australian Museum, Sydney, N.S.W. **a** distant front view **b** side view **c** close up of front view: 3 photos by G. Bennett. Annot.

18 American Museum of Nat. Hist. **a** eastern front, general view and plan of principal floor: 1 s. engr. **b** layout plan: 1 photo. Annot.

19 American Museum of Nat. Hist. **a** plan of transverse section **b** plan of longitudinal section: 2 photos. Annot.

20 **a** *Rossia palpebrosa* ovary & oviduct, diss.: 1 p.i. & wash d. [R.O. del.] P: *Trans. zool. Soc. Lond.* **2** 1838 p.21 f.18 **b** [Fish] circulatory system: 1 c.d. Annot. **c** [? *Oryctolagus*] ?ear, circulatory system of part: 1 w.d. *cf.* Palmer, J. F. *The works of John Hunter* Lond. 1837, Atlas pl.20 **d1** Tape worm: **d2** [Liver fluke] circulatory systems: 2 w.d. Annot. **e** *Sus scrofa* diseased & healthy ovaries: 5 w.d. Annot. **f** [Class unident.] circulatory system of kidney, liver, testicle & salivary glands: 4 w.d. Annot. **g** [?Rodent unident.]♂ reproductive system, diss.: 1 w.d. **h** [?*Oryctolagus*] heart, l. lat.: 1 w.d. **i** [? Aves] ? syrinx: 1 w.d. **j** [? Aves] valves of aorta: 1 w.d. Annot.

21 **a** *Homo sapiens* auditory nerve, diss. **b** [*Bos*] auditory nerve of calf, diss.: 2 wash d. W.C. del. Annot. **c** Swordfish [Percomorpha – Scombroidei: genus unident.] eye, longitudinal section: 2 p.d. P: Owen, R. *Anat. of Vertebrates* Lond. 1866 **1** f.216, p.332 **d** [Class unident.] ? ganglion, blood vessel & nerves or lymphatics or gut & associated vessels 1 p.d. **e** [? Amphibia] heart, whole & diss.: 1 w.d. 1 p.d. Annot. **f** [?Bivalvia] ?mesentery: 1 p.d. Freudenberg del. Annot. **g** [*Ornithorhynchus paradoxus* [*anatinus*]] **g6** abdomen, intestines in situ: **g7,8** stomach & spleen diss. out: **g9** heart & spleen diss. out: **g10** urinogenital system diss. out: **g11** urinogenital system in situ: **g12** bladder 7 p.d. R.O. del. Annot P: *Trans. zool. Soc. Lond.* **1** 1835 pl.33 **h** [*Homo*] Cowpers gland in situ: 1 p. sketch. Annot.

22 **a** [? Mammalia] ? limb diss., showing muscles, nerves & blood vessels: 1 crayon & w.d. H.S. del. **b** [? Mammalia] brain, sagittal section: 1 w.d.

23 Flint, 'supposed fossil bull' **a,b** 2 wash d. Annot.

24 *Homo sapiens* in a semi-handstand position showing osteology, above an outline d. of a crocodile: p.d. H. V. Carter del.

25 **a** † *Rytidosteus* [*Rhytidosteus*] *capensis** pal. tooth, transverse section: 1 p.i. & w.d. A. H. Searle del. Annot. P: *Q. Jl geol. Soc. Lond.* **40** 1884 pl.17 f.2 from HOLOTYPE *No. R. 455 **b**† [*Mastodonsaurus*] tooth, part of transverse section, magnified: 1 p.d. Annot. **c** †*Labyrinthodon pachygnathus*

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[*Mastodonsaurus laniarius*] tooth, part of transverse section magnified: orig. i. sketch & engraving P: *Trans. geol. Soc. Lond.* **6** 1842 p.511 f.2

26 **a** † *Labyrinthodon* [*Mastodonsaurus*] *scutulatus* vertebra: 3 views 3 p. sketches G.S. del. Annot. P: *l.c.* pl.46 f.3,4 **b** † *Labyrinthodon* [*Mastodonsaurus*] episternal: 1 s. & p.d. [G.S. del.] Annot. P: *l.c.* pl.45 f.9,10 **c** † *Labyrinthodon dolicognathus* [*Mastodonsaurus pachygnathus*] maxillary fragment & teeth, lat. & occ.: 2 s.d. G.S. del. Annot. **d** † *Labyrinthodon* [*Mastodonsaurus*] *pachygnathus* vertebral fragment, 3 views: 1 s.d. & 2 p. outlines P: *l.c.* pl.45 f.2,4,1

27 † *Labyrinthodon* [*Mastodonsaurus*] *pachygnathus* **a** upper jaw & ant. frontal fragments: P: *l.c.* pl.43 f.9,11 **g** cranial bone fragments in slab **a,g** 6 d. P: *l.c.* pl.46 f.6,7 **b** † [*Mastodonsaurus*] tooth, occ.: 1 d. Annot. **c** † *Labyrinthodon* [*Mastodonsaurus*] *ventricosus* tooth, lat.: 1 d. **d** † [Saurian] incomplete tooth, lat.: 1 d. **e,f** † *Labyrinthodon* [*Mastodonsaurus*] *laniarius* tooth, 2 lat. Annot. All w.d.

28 **a** *Menopoma* [*Cryptobranchus*] circulatory & respiratory system of adult: 1 w.d. **b** *Menobranchus* [*Necturus*] sk. dors.: 1 i. sketch. Annot. **c** [Caudata] vent. diss. to display viscera: 1 w.d. **d** [*Siren lacertina*] diss. to show heart in situ: 1 wash d. T. Rymer Jones del. P: *Trans. zool. Soc. Lond.* **1** 1835 pl.31 f.1 **e** *Triton* [*Triturus*] larva, circulatory & respiratory system diss. out: 1 w.d. **f** *Menopoma* [*Cryptobranchus alleghaniensis*] articulated skel. l. lat.: 1 p.d. [? G.Owen del.] P: Owen, R. . . . *Anat. of Vertebrates* Lond. 1866 **1** f.43 p.48 **g** Frog larva [? genus] branchial arches: 1 c. diagram

29 **a,b** [Anuran] vent. diss. to show viscera **b** ovaries full of eggs: 2 w.d. **c,d** American Tree Frog [? genus] dors. & vent.: 2 i. & w.d. Capt Chapman del. Annot.

30 **a–e** [Anuran] larval development, l. lat. **f** 2 vent. diss. to show gut **a–f** 7 w.d. Annot.

31 **a** *Exocoetus volitans* tongue, oesophagus, gut & superbranchial organ: 2 i. sketches. Annot. **b** *Diodon* whole animal showing diss. of brain: 1 p. sketch. Annot. **c** *Pristipoma* [*Gymnocephalus cernua*] cranium, l. lat.: 1 p.d. West del. P: Owen, R. . . . *Archetype & homologies of vertebrate skel.* Lond. 1848 pl.7 f.2 **d** Lamprey [*Lampetra*] l. lat.: 1 p. sketch **e** [*Esox lucius*] hyoid skel.: 1 i. & c.d. Annot. **f** *Amphioxus* [*Branchiostoma*] whole animal, l. lat.: 1 c.d. Annot. *Bagrus* [*Bagre*] **g** sk. post. region, dors. **i** sk. sagittal section **g,i** 2 pen & w.d. **i** R.O. del. P: *l.c.* pl.1 f.4,3 **h** Dory [*Zeus faber*] myobranchial skel. showing elements: 1 c.d. **j** *Xiphias gladius* syncranium, atlas & axis, sagittal section, l. lat.: 1 p.i. & w.d. P: *l.c.* pl.1 f.5. **c,g,i,j** T. West lith.

32 **a** † *Ganolodus* [*Rhizodopsis*] *craggesii** jaw fragments with teeth *No. P.4794: 2 s.d. Annot. P: *Trans. odont. Soc. Gt. Br.* **5** 1867 p.356 f.2 **b** † *Edestes* [*Edestus*] symphysial tooth-whorl: 1 w.d. Annot. **c** † *Palaedosteus* [*Lepisosteus*] vertebra, 4 views: 4 w.d. Annot. **d** † [*Saurostomus* [*Prosauropsis*] *exocuus*] jaw fragment with teeth, lat.: 1 w.d. Annot. **e** † [*Lepidotus* [*Lepidotes*] *elvensis*]* head & trunk, l. lat.: 1 p.d. E. Blorles del. Annot. *No. 18992

33 **a** † *Carcharodon* [*megalodon*] tooth, lat.: 1 i. outline d. Annot. **b** † *Labyrinthodon* [*Mastodonsaurus*] tooth, lat. & occ.: 2 w.d. M.M. del. Annot. **c,d** † *Carcharodon* [*megalodon*] **c** tooth, lat.: Annot. **d** tooth, incomplete, lat.: Ross del Annot. **c,d** 2 w.d. **e** [*Hippocampus*] dried spec. l. lat. Photo. Annot. **f** † *Rhizodus* jaw fragment with teeth: p. sketch. Annot.

34 † [*Caturus furcatus*]* **a** skel. in matrix, r. lat.: 1 p.d. *No. 37024 **d** head, l. lat.: 1 p.d. **b**†[*Enoploclytia leachii*] 2 incomplete fingers of claw, lat. in matrix: 1 w.d. Annot. **c** † *Cochliodus* [*contortus*]* † *Tomodus* [*convexus*] [*Cochliodus contortus*]* m. occ.: 2 p.d. P: *Geol. Mag.* **4** 1867 pl.3 f.1, pl.4 f.2. Annot. Casts *Nos P5850 & P5849 **e** † *Xystrodus* [*Platyxystrodus*], † *Deltoptychius*, † *Deltodus sublaevis* tooth plates, 5 views: 5 p.d. **b** W. H. Hatcher del.

35 **a** † *Parabatrachus colei* [*Megalichthys hibberti*]* r. maxilla with teeth & scale in matrix, l. lat.: 1 w.d. J. Dinkel del. Fig. *Q. Jl geol. Soc. Lond.* **9** 1853 p.2 f.1 HOLOTYPE of *Parabatrachus colei* Owen *No. 29673 **b** † [*Sphyraenodus* or *Eocoelopoma*] incomplete sk. including part of m. with teeth in matrix: 1 w.d. J. Dinkel del. Annot.

36 † [*Stereodus melitensis*] part of cranium & 10 vertebrae in slab, l. lat.: 1 w.d. M. Bellanti del. Annot.

37 **a** [*Lamna nasus*] whole animal, l. lat.: 1 wash d. Annot. **b** *Squalus* [*Cetorhinus*] *maximus* stomach & intestine, diss.: 1 wash d. [? W.C. del.] prelim. d. for *Phil. Trans. R. Soc.* **99** 1809 pl.8 f.1

38 [*Squalus acanthias*] vent. diss. to show ♀ viscera: 1 wash d.

39 [*Squalus acanthias*] vent. diss. to show ♂ viscera: 1 wash d.

40 **a–c** *Squalus* [*Cetorhinus*] *maximus* gastric epithelium: 3 wash d. W.C. del. Annot.

41 *Squalus* [*Cetorhinus*] *maximus* **a** cerebellum diss. out, lat.: 1 wash d. Annot. **b** *Squalus* stomach & intestine, longitudinal diss.: 1 wash d. Annot. **c** *Squalus* [*Cetorhinus*] *maximus* notochord & vertebral centrae, longitudinal section: 1 w.d. R. Mylne del. Annot.

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42 **a** *Squalus* [*Cetorhinus*] *maximus* ♂ stranded on beach, l. latero-vent.: 1 w.d. **b** engraving of same

43 *Squalus alopecias* [*Alopias vulpinus*] l. lat.: 1 outline i. & wash d. W.C. del. Annot.

44 **a** *Selachia* [*Cetorhinus maximus*] oesophagus, small section: 1 wash d. **b** [*Sphyrna zygaena*] diss. of olfactory organ & optic nerve, vent.: 1 wash d. **c** *Carcharhias* [*Carcharhinus*] teeth 1,6,10,11,12 *Lamna* teeth 1,6,10: 14 wash d. Annot. **d** [*Myliobatid ray*] teeth, 2 views: 2 p.d.

45 **a** *Merlangus vulgaris* [*Merlangius merlangus*] head of 3 eyed specimen with median eye: 1 p.d. W.C. Maclean del. Annot. **b,c** *Salmo salar* head of deformed salmon: 1 photo. 1 outline sketch. Annot.

46 *Lepidosiren* [*Protopterus annectens*] **a–c** head musculature **d** alimentary canal **e** brain & inner ear **g** scale **h** dentition & olfactory organs: 8 p. & wash d. **d,h** H.S. del. **e** R.O. del. **P**: *Trans. Linn. Soc. Lond.* **18** 1841 pl.24 f.4–6; pl.25 f.2; pl.27 f.1–4 **f 1** *Menopoma* [*Cryptobranchus alleghaniensis*] **f 2** *Menobranchus* [*Necturus*] brains, diss.: 2 p.d. **P**: *l.c.* pl.27 f.5,6

47 *Lepidosiren* [*Protopterus annectens*] **a** & **c** brachial & pharyngeal regions **a** dors. **c** vent. with heart **b** digestive, urinary & reproductive organs: 3 w.d. H.S. del. **P**: *l.c.* pl.26 f.1,2; pl.27 f.7

48 *Lepidosiren* [*Protopterus annectens*] **a** notochord, ribs & muscles **b** heart & lungs in situ **c** viscera in situ: 3 w.d. H.S. del. **P**: *l.c.* pl.24 f.2,3; pl.25 f.3; pl.25 f.1.

49 *Lepidosiren* [*Protopterus annectens*] **a** skel. r. lat. **b** sk. dors. **c** whole animal, lat. dors. & transverse section **d** superficial body musculature, l. lat.: 4 w.d. & 2 i.d. H.S. del. **P**: *l.c.* pl.23 f.4,5,1,2; pl.24 f.1

50 [? *Hippurites*] **a** l. valve **b** ? section through r. valve **c** r. valve: 3 p.d. Annot. **d,e** [? *Buccinum undatum*] 3 diss. ant.: 3 wash d. **f** [? *Carinaria* or *Pterotrachea*] animal swimming, lat.: 1 c.d.

51 **a** *Chiton spiniferus* [*Chaetopleura spinulosa*] vent. & dors.: 2 w.d. [?Cooper del.] Annot. **b** *Doris* dors. diss.: 1 w.d. **c** [Genus unident. possibly † *Spondylus*] 1 w.d. W.C. del. Annot. **d** [*Pecten maximus*] l. valve with incrustation [*Musculus marmoratus*] 6 views: **lower** [?Chaetognatha] lanceolate specimen diss. magnified & nat. size [11·5 mm] 2 w. & p.d.

52 **a–e** *Strombus* [*Lambis*] *chiragoa* 8 general diss.: 10 w. & i.d. Annot.

53 **a** *Cypraea* 4 d. **b** *Conus* 10 d. **c,d** *Strombus* [*Lambis*] 6 d. including shells **e** *Terebellum* 5 d. including shell **f** *Cypraea* 16 d. 2 with shells. Annot. **a–f** All general diss. All w.d.

54 [Octopus, unident.] Japanese ivory sculpture (Netsuke) showing bather attacked by octopus: 5 c.d. one **P**: *Trans. zool. Soc. Lond.* **11** 1881 p.166 f.4. Annot.

55 **a** † *Nautilus* [*Cenoceras*] *striatus* median section 5 i. & w.d. Annot. **b** *Nautilus pompilius* diss. of animal removed from shell: 1 p.d. Annot. **c** *Nautilus* [*Cenoceras*] *obesus* side view of internal cast of shell: 1 p.i. & w.d. **d** † [*Cenoceras*] shell & internal mould & view with side partly cut away, 3 p.i. & wash d. **e** [? *Eutrephoceras* or *Cenoceras*] side partly cut away: 3 p.i. & wash d. **f3**† *Ammonites lingulatus* [indeterminate Oppelid ammonite] lat. & aptychi **f4** † *Ammonites* [*Oppelia*] *subradiatus* ant. with pair of aptychi in the aperture: 3 p.d. [R.O. del.] **f P**: *Proc. zool. Soc. Lond.* **1878** pl.60 f.1,2 **g10** † [*Hildoceras bifrons*] ant. & lat.: 2 d. **g11** † [*Lytoceras fimbriatum*] 2 d. **g12** † [*Harpoceras*] 2 d. **g13** [Belemnitida, unident.] 6 d. **g** All pen, i. & wash d. Annot.

56 **a,b** *Pholadomya* [*candida*] morphology of animal removed from shell: **a** with details of mantle: 3 w.d. H.S. del. Annot. Mentioned *Proc. malac. Soc. Lond.* **40** 1972 p.47 **c** *Calypeopsis* [*Calyptraea byronensis*] shell, dors. & vent. & 6 diss.: 8 w. & i.d. R.O. del. **P**: *Trans. zool. Soc. Lond.* **1** 1835 pl.30 f.1–7 **d** *Clavagella* [(*Bryopa*) *lata*] 9 diss. parts: 8 p. & w.d. R.O. del. **P**: *l.c.* pl.30 f.8–16

57 **a** [*Teredo*] lat. with added detail: 2 w.d. Annot. **b** *Teredo gigantea* [*Kuphus polythalmia*] lat. view of case: 1 w.d. W.C. del. Annot. Mentioned in *Phil. Trans. R. Soc.* **96** 1806 p.269 **c** [*Pennella*] 6 parts including 3 diss.; 6 w.d. Annot.

58 **a left** *Teredo* Annot. **centre** *Teredo banksii* Annot. **right** *Teredo clava* [? *Uperotus clavus*] Annot. 4 i. sketches **b** *Teredo* [? *navalis*] 11 p.i. & w. sketches: **verso** [*Teredo navalis*] 3 diss.: 3 w. sketches [W.C. del.]. *Teredo gigantea* [*Kuphus polythalmia*] **c** case, external: 1 w.d. Annot. **P**: *Phil. Trans. R. Soc.* **96** 1806 pp.269–275 **d** case, internal: 1 w.d. **P**: *l.c.* pl.11 f.6. **verso** end of case: 1 w.d. **P**: *l.c.* pl.10 f.2 **e** case, part of exterior: 1 w.d. Annot. Both **c** & **e** are parts of a specimen figured *l.c.* pl.10 f.1 **f** case, transverse sections & external appearance: 4 w. & p.d. [W.C. del.] Annot. **P**: *l.c.* pl.10 f.5,4; pl.11 f.7

59 **a** *Spirula* [*peronii*] [*S. spirula*] **a1** lat. **a4** ant. **a5,6** post. **a7** distal end of body × 2: **a11** specimen with mantle laid open: **a15** diss. of head & internal organs: *Spirula* [*reticulata*] **a3** lat. of mutilated specimen **a9** distal end of body × 4: **a10** section of distal end. *Spirula* **a12** internal structures **a13** circulatory structures **a14** liver: **unnumbered** peduncle magnified **unnumbered** [unident.] part. 15 p.d. **P**: Adams, A. *Zool. Voy. Samarang* Lond. 1848 Mollusca pl.4

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Spirula [*australis*] diss. **b** 12 p. & i.d. **c** 9 p. & i.d. **d** 6 p. & i.d. **b–d** P: *Ann. Mag. nat. Hist.* (5) **3** 1879 p.1–3 **e** Anatomy including diss.: 7 p. & w.d. Bergeau del. P: *Proc. zool. Soc. Lond.* **1880** pl.32

60 **a** *Sepioteuthis brevis* [*lessoniana*] vent. diss.: 1 w.d. T. Rymer Jones del. P: *Trans. zool. Soc. Lond.* **11** 1881 pl.26 f.1 HOLOTYPE of *S. brevis* **b** *Sepiola* [*Sepietta*] *owenii* ♂ reproductive organs: 1 p.d. R.O. del. P: *l.c.* pl.26 f.2 (**c–g**) *Loligopsis ocellata* **c** suckers & transverse section of tentacle **d** mouth **e** gladius **f** beak & suckers **g** whole animal, dors.: 10 i. & w.d. **d–g** H.S. del. P: *l.c.* pl.26 f.3–8, pl.27 HOLOTYPE of *L. ocellata*

61 *Onychoteuthis raptor* [*banksii*] **a** gills & digestive system **c** vent. diss.: 2 p. & 1 i.d. R.O. del. P: *l.c.* pl.29 f.2–4 HOLOTYPE of *O. raptor* **b** [*Plectoteuthis* [*Architeuthis*] *grandis*] 3 views of tentacles including section & suckers: 4 wash d. P: *l.c.* pl.34, 35

62 *Enoploteuthis cookii* **a** mouth, vertical section **b** beak, lat.: 2 i. & w.d. T. Rymer Jones del. P: *l.c.* pl.31 f.1; pl.30 f.2 **c** systemic ventricle, diss. **d** section of unciferous actabulum **e** cephalic arm, distal end, transverse section **f** cephalic arm showing tentacles: 5 w.d. P: *l.c.* pl.32 f.1–6 **g** body, transverse section showing fins: 1 wash d. P: *l.c.* pl.31 f.4 HOLOTYPE

63 *Enoploteuthis cookii* post. end, dors.: 1 wash d. P: *l.c.* pl.31 f.3. Annot. [Specimen collected on Capt Cook's 1st Voyage was in Hunterian Mus. Coll. No. E 1066 probably destroyed by bomb in 1941.] HOLOTYPE

64 *Enoploteuthis cookii* vent.: 1 wash d. P: *l.c.* p.31 f.2. Annot. HOLOTYPE

65 **a** [? *Sepiola*] dors.: 1 w.d. **b** *Tritaxeopus* [*Octopus* (*Tritaxeopus*)] *cornutus* whole animal, dors. & detail of mouth: 2 w. & i.d. P: *l.c.* pl.23 f.1,2. HOLOTYPE of *T. cornutus*

66 *Ommastrephes ensifer* whole animal, dors. & details of tentacles 3 d. (1 c. 1 i. 1 p.) P: *l.c.* pl.28. Annot. HOLOTYPE

67 **a** *Octopus semipalmatus* [*Tremoctopus vidaceus*] whole animal, dors. & vent. diss.: 2 p.d. R.O. del. P: *l.c.* **2** 1838 pl.21 f.12,13 **b** [*Argonauta hians*] ovum: 1 p.d. R.O. del. P: *l.c.* pl.21 f.15 **c** *Sepioteuthis* and valves, closed & open: 2 p.d. R.O. del. P: *l.c.* pl.21 f.16 **d** *Sepia officinalis* statocyst, diss.: 1 p.d. [R.O. del.] P: *l.c.* pl.21 f.17 **e** *Cranchia scabra* 5 d. numbered 1–5: *Loligo laticeps* [*Onykia carribaea*] 5 d. numbered 6–10: entire animals & diss. parts: 10 p.d. R.O. del. P: *l.c.* pl.21 f.1–10 **f** *Argonauta hians* mantle diss.: 2 wash d. Annot. **g** *Loligo laticeps* [*Onykia carribaea*] oral view: 1 p.d. [R.O. del.] P: *l.c.* pl.21 f.11 **h** *Nautilus pompilius* tentacle, inner surface magnified: 1 c.d. P: *Ann. Mag. nat. Hist.* **12** 1843 p.308 f.1

68 **a** *Caninia* [*Caninulua*] *lineata* longitudinal diss. nat. size & enlarged detail: 2 p.d. & w.d. **b** [Family Nereidae, unident.] **A,B** dors. & vent. **C** head with pharynx everted **D,E** parapodia, midbody & post end: 5 p.i. & w.d. R.O. del. **c** [Polychaeta, unident.] ant. end, dors.: 1 p. & w.d. **d** [Family Phyllodocidae, unident.] ant. end, dors.: 1 w.d. **e** [*Nephtys*] dors. view with pharynx everted: 1 w.d. C. A. O[wen] del. **f** [Echiuroinea; genus unident.] diss.: 3 w.d. R.O. del. Annot. **g** *Ascaris halichoris* [*Dujardinascaris halicoris*] diss. & detail of ant. region: 2 p.d. R.O. del. **h1** *Linguatula proboscidae* **h2** *Sipunculus phalloides* [? part] detail: *Strongylus* [*Dioctophyme*] *gigas* **h3** diss. of post. & ant. ends: 4 p.d. R.O. del. **i** uterus & vagina, diss.: 1 p.d. R.O. del.

69 [*Arenicola*] **a** entire specimen, external appearance & details of parts: 5 p. & w.d. **b** alimentary canal diss. out: 2 p. & w.d. **c** [*Moniezia*] whole specimen, segments & scolex: 5 w.d. Annot. **d** † *Helminthodes* [? *antiquus*] entire specimen: 1 photo. Annot. [? specimen announced by O. C. Marsh in *Amer. J. Sci.* **38** 1864 p.415] **e,f** [Lumbricidae] vent. diss. showing alimentary canal & typhlosole: 2 p. & wash d. Annot.

70 **a** *Trichosoma* [*Capillaria*] *caprimulgi* head, tail, eggs, anus & vulva: 5 p.d. **b** *Taenia decupata* [possibly *Anoplotaenia dasyuri* or *Dasyurotaenia robusta*] ant. end of worm, scolex & lat. portion of strobila: 3 p.d. Annot. *Linguatula taenioides* **c** vent. view & ova: 6 p.d. & autograph description **g,h** ant. & post. ends of worm, vent. diss.: 4 p.d. **i** nervous & reproductive system diss. out: 3 p.d. R.O. del. P: *Trans. zool. Soc. Lond.* **1** 1835 **c** pl.41 f.10,15,16 **g–i** pl.41 f.11–14 **d** [? *Breinlia*] whole animal, alimentary canal, diss.: 2 p.d. Annot. **e** *Trichospira* or *Trichina* [*Trichinella spiralis*] cysts & worm: 7 p.d. R.O. del. Annot. **f** [*Trichinella spiralis*] cysts & worm: 3 wash d. Annot. **j** *Trichina* [*Trichinella*] *spiralis* cysts & worm diss. out: 9 p. & c.d. R.O. del. P: *l.c.* pl.41 f.1–9 **k** *Distoma clavatum* [*Hirudinella clavata*] external anatomy & diss. vent.: 4 p.d. P: *l.c.* pl.41 f.17–20 **l** *Taenia lamelligera* anatomy, including details of segments: 3 p.d. R.O. del. P: *l.c.* pl.41 f.21–23 **m** *Trichospira* [*Trichinella spiralis*] manuscript notes for drawings made by 'Mr. Paget' [later Sir James Paget] from . . . demonstrations by J. Jos. Bennett . . . confirmed by Robt. Brown, F.R.S. . . . [It is not clear to which drawing this refers – none signed by Paget or credited to him ? f.]

Folio

71 **a5** *Lernentoma nodosa* [*Chondracanthus nodosus*] 2 w.d. **a6** *Lernentoma* [*Acanthochondria*] *cornuta* 2 w.d. **b** *Lernentoma gobina* [*Diocus gobinus*] 2 w.d. engr. P: Jones, T. Rymer *Outline . . . organization . . . Anim. Kingdom* 4th ed. Lond. 1871 f.351a,b. **c** *Lernoeca radiata* [*Chondracanthodes radiatus*] 2 w.d. engr. P: *l.c.* f.351c,d. **d** [*Lernaeopoda*] 7 w.d. R.O. del. Annot. **e2** [*Clavella adunca*] 2 w.d. **e lower** [*Kroyeria*] 2 p.d. **f** [*Lernaeocera branchialis*] 1 w.d. Annot. **g** *Goodsirus* [*Hemioniscus*] *balani* developmental stages: 8 i.d. Annot. **h** *Lepeophtheirus pectoralis* 2 w.d. Annot. **i** *Peniculus clavatus* 2 w.d. Annot. All except **d, e lower** & **g** copies of plates in Müller, O. F. *Zoologiae Danicae* . . . fasc. 1–2 Hauniae, 1777–80, pls 33 & 118

72 *Limulus polyphemus* diss. to show **a1** alimentary canal, dors.: **a2** circulatory system, dors. P: *Trans. Linn. Soc. Lond.* **28** 1873 pl.36 **b** longitudinal diss. to show internal anatomy: f.1,2 P: *l.c.* pl.37 **c1** central nervous system, vent.: **c2** eye & ocular nerve: **c5** entosternon & attached muscles: **c6,7** ♀ reproductive system P: *l.c.* pl.38. **c3,4** † *Phacops conophthalmus* [*Chasmops extensa*] eye & magnified sections: P: *l.c.* pl.38: All p. drawings

73 **a** *Porcellana coccinea* [*Petrolisthes coccineus*] dors. & vent. & details of parts: 4 w. & i.d. P: *Zool. Capt. Beechey's Voyage* Lond. 1839 pl.26 f.1,2 **b1** *Gelasimus* [*Macrophthalmus*] *telescopicus* described by R. Owen *Cat. Mus. R. Coll. Surgeons of England* pt. 4 fasc. 1 Lond. 1830 p.78 No. 291 **b3** *Grapsus* [*Metagrapsus*] *thukuhar* described by R. Owen *l.c.* p.80 No. 294 B: 9 i. & w.d. P: *Zool. Capt. Beechey's Voyage*, Lond. 1839 pl.21 **c** [?*Acturus*] l. lat. & details of parts: 5 w.d. Annot. **d1** *Pagurus pictus* [*Labidochirus splendescens*] **d2** *Pagurus splendescens* [*Calcinus elegans*] 2 w. &i.d. P: *l.c.* pl.25 Both described by Owen *Cat. Mus. Roy. Coll. Surgeons of England* Lond. 1830 pl.4 84 & 83 Nos 305 C & 302 B **e** [Section Anomura: sp. unident.] 4 i. outline d. **f** † *Phacops conophthalmus* [*Chasmops extensa*] part magnified to show eye: 1 c.d. **g** † *Bellinurus* [*Belinurus*] dors.: 1 w.d. Annot.

74 **a** *Crangon* [*Sclerocrangon*] *salebrosus* l. lat. view & parts: 6 i.d. R.O. del. P: *Zool. Capt. Beechey's Voyage*, Lond. 1839 pl.27 f.1 **b** *Squilla* [*Pseudosquilla*] *ciliata* r. lat. view & parts: 7 i.d. P: *l.c.* pl.27 f.5 **c** & **f** [Family Parastacidae – Genus unident.] **c** l. lat. diss. to show ? gills **f** dors.: 2 i. & w.d. T. R. Jones del. **d3** *Hippolite beacheyi* [*Heptacarpus* or *Eualis*] **d4** *Hippolite leachei* [*Spirontocaris affinis*] Annot. 2 p.d. P: *l.c.* pl.27 **e** *Hippolite armata* [*Lebbeus groenlandicus*] l. lat. view & parts: 6 i. & w.d. R.O. del. P: *l.c.* pl.27 f.2

75 *Julus terrestris* **a** ant. end of dors. vessel **b** middle of dors. vessel **c** 3 diss. to show brain & neural chord, dors. & vent. **a–c** Annot. **e** portion of vent. nervous system **f** *Cermatia* [*Scutigera*] pylorus diss. 7 c.d. **d,g–i** *Polydesmus* **d** dors. diss. to show central nervous system: 1 w.d. **g,j** middle portion & caudal end of dors. vessel magnified: 2 p.d. **h** ant. portion of dors. vessel, magnified: 1 w.d. **i** diss. to show alimentary canal, magnified: 1 w.d.

76 **a** [*Borocera*] ♀ moth, coccoon, caterpillar & egg. 3 w.d. E. Home del. Annot. **b** [Scorpiones] vent. diss. to show alimentary canal: 1 incomplete outline & w.d. **c** [*Periplaneta americana*] vent. diss. to show dors. vessel: 1 w.d. Annot. **d** [*Goliathus goliatus*] dors. view: 1 wash d. **e** Lepidoptera, bile tube of caterpillar: 1 daguerreotype by Goadby, Sol & Claudet. Annot.

77 **a top** *Nereis* [Family Alciopidae ? – planktonic polychaete – not *Nereis*] 4 w.d. **a middle** ? *Phronimia* [*Phronima*] complete spec. l. lat. & detail of head & appendages 7 w.d. Annot. **a bottom** [Medusa, unident.] 3 w.d. **b** [Class unident. marine form, eggs] 1 w.d. Annot. **c** *Dagysa* [*Thetys vagina*] diss.: 3 i. & w.d. **d** *Dagysa volva* [aggregate form of Salp] lat.: 1 w.d. S. Parkinson del. 1768 **e line 1** [Coelenterate hydromedusa & Siphonophora, unident.] **e line 2** Medusae **e line 3** [? Chaetognatha] & [? Pteropod mollusc larva] **e** 8 p. & w.d. **f top** *Beroe* whole & diss. 4 views, 1 w.d. & 3 i. sketches **f lower** [? Salp] 3 views: 3 p. & w. sketches **g** [? *Pegea confoederata*] 3 views: 3 p. & w.d. **h top** [? *Salpa maxima*] 2 views: 2 p. & w.d. **h lower** [? Salp] 3 views: 3 p. & w. sketches **e–h** All del. 1836. All Annot.

78 **a,c** *Sipunculus* diss. 3 p. & w.d. R.O. del. **b** [*Heterocentrotus*] part of test showing spines & muscle attachments: 1 p.d. Annot.

79 **a** grid of $\frac{9}{16}$ inch squares: 1 p.d. Annot. **b** [Invertebrate, unident.] 1 w. & p.d. **c** [*Tealia felina*] 3 lat. views: 1 w.d. **d** *Isis ochraceus* longitudinal section & 'coral joints': 3 i.d. Annot. [see *Phil. Trans. R. Soc.* **90** 1800 pp.327–402] **e** [Cucumariidae] lat. views **e1** tentacles extended **e2** animal contracted: 2 w.d. Annot.

80 **a** *Physalis pelagica* [*Physalia physalis*] lat. view of living specimen: 1 w.d. G. Owen del. **b** *Physalis* [*Physalia physalis*] lat. view of whole & parts in detail: 7 w. & i. sketches Annot. **c** *Physalia* [*physalis*] lat. view of living animal & 2 sketches of sections & vent. view: 1 w.d. & 3 i. sketches. Annot.

81 **a,b** *Terebratula* [*Hemithiris*] *psittacea* diss.: 4 p.d. R.O. del. P: *Trans. zool. Soc. Lond.* **1** 1835 pl.22

Folio

f.14*,14,13,12 **c** *Terebratula* [*Terebratella*] *chilensis* diss. & magnifications: 11 p.d. Annot. *Terebratula* [*Terebratella*] *sowerbii* diss.: 2 c.d. Annot. P: *l.c.* pl.22 **d,e** *Lingula* [*Glottidia*] *audebardii* anatomy: 2 p.d. R.O. del. P: *l.c.* pl.23 f.15,16

82 **a** *Distigma proteus* 9 views of organisms **b** *Distigma* [*Eutreptia*] *viridis* 6 views of organisms **c** *Lagenula* [*Lagenella*] *euchlora* [*Trachelomonas lagenella*] 3 views of organisms **d** *Microglena monadina* [? zoospores of *Ulothrix zonata*] 5 views **e** *Eudorina elegans* 4 views of colonies **f** *Microglena volvocina* [*M. punctifera*] 4 views of organisms: 6 w.d. [? All copied from Ehrenberg, C. G. *Die Infusionsthierchen* . . . Atlas, Leipzig 1838 pls 1,2,3 & 8]

83 **a** *Euglena sanguinea* 6 views of organisms **b** *Euglena acus* 16 views of organisms including binary fission & movement **c** *Euglena longicauda* Ehr. *Vibrio aco* Müller [*Phacus longicauda*] 3 views of organisms **d** *Euglena* [*Phacus*] *pyrum* 4 views of organisms **e** *Amblyophis* [*Euglena*] *viridis* 2 views of organisms **f** *Ophryoglena flavicans* 3 views of organisms: 6 w.d. [? All copied from *l.c.* pl.7 f.6,15,13,11,5; pl.40 f.8]

84 † *Lama* [*Odontaspis*] *elegans* tooth, longitudinal section: 1 p.d. P: Owen, R. *Odontography* . . . Lond. 1840–45 **2** pl.6

85 **a** [*Sargus rufescens*] incisor, part of transverse section: 1 w. & i.d. J. Dinkel del. P: *l.c.* pl.43 f.2 **b** † *Scaparnodon* [*Sceparnodon*] *ramsayi* [*Phascolonus gigas*] incisor, part of transverse section: 1 p.d. C. Berjeau del. Annot. **c** † *Megatherium* molar, part of transverse section: 3 p.d.

86 **a** † *Liodon* tooth, transverse section, magnified: 4 c.d. varnished. S. W. Leonard del. **b top left** (f.6a,b) † [? *Hylaeosaurus*] tooth: 2 w.d. † [*Mormorosaurus obtusus*] **b lower left** (f.5a,b) tooth: 2 views **c** enamel surface, magnified: 2 w.d. & 1 p.d. **b top right** (f.1c) tooth: 2 w.d. Annot. **b lower right** (f.3) † *Cardiodon rugosus* [*rugulosus*] **a,b** tooth: 2 views: **c,d** enamel surface, magnified: 3 w.d. & 1 p.d. Annot. All **b** P: *l.c.* pl.75a f.5–7 **c** † *Dendrodus* [*biporcatus*] **c top** tooth, transverse section: 1 p. & w.d. **c lower** tooth, lat. & outlines of transverse sections: 3 i.d. **c lower** P: *l.c.* pl.62A f.1. Annot.

87 **a** *Iguana tuberculata* [*iguana*] tooth, part, transverse section: 1 i.d. J. Dinkel del. P: *l.c.* pl.69 f.1. Annot. **b** † *Iguanodon* tooth, transverse section 1 i.d. J. Dinkel del. P: *l.c.* pl.7I **c1&2** *Python* tooth, transverse section: 2 i.d. J. Dinkel del. P: *l.c.* pl.65B f.1,2 **c bottom** † *Mosasaurus* tooth, transverse section: 1 i.d. P: *l.c.* pl.69 f.3

88 **a** † *Acrodus* tooth, medullary canals: 1 p.d. L. Aldous lith. P: *l.c.* pl.16 f.3 **b** [order unident.] tooth or bone section: 1 p.d. **c** † *Theriosuchus pusillus* dermal scutes: 4 p. & i.d. D. Blair del. Annot. **c2** P: Owen, R. . . . *Reptilia* . . . *Wealden Formations* Suppl. 9 Crocodilia *Palaeontogr. Soc.* (*Monogr.*) 1879 pl.2 f.11 † *Nuthetes* [*Megalosaurus*] *destructor** **d** dermal tubercles & teeth: 10 p.d. D. Blair del. Annot. P: *l.c.* pl.2 f.13–22 (f.13,14)* No. 48207 (f.15)* No. 48208 (f.18–21)* No. 48247 **e** section of a ‘granicone’: 1 i.d. D. Blair del. P: *l.c.* f.23 **a–e** All include magnified sections

89 **a** *Homo sapiens* [? *Pan troglodytes*] tooth, longitudinal section: 1 i.d. Annot. P: Owen, R. *Odontography* . . . Lond. 1840–45 **2** pl.119a **b** *Macropus* tooth, longitudinal section: 2 i.d. J. Dinkel del. P: *l.c.* pl.102 **c** † *Megatherium* tooth, magnified longitudinal section: 1 ink & wash d. J. Dinkel del. P: *l.c.* pl.84 **d** † *Glyptodon* tooth, longitudinal section: 1 i.d. J. Dinkel del. P: *l.c.* pl.86 **e** † *Odontopteryx toliapicus* [*toliapica*] ‘flight processes’: 2 i. & wash d. D. Blair del. Annot. **a–e** All include magnified sections

90 **a,d** *Myliobatis aquila* longitudinal, vertical & transverse sections of teeth: 2 w.d. J. Dinkel del. P: *l.c.* pl.26,27 **b** † [Order unident.] tooth sections: 2 c.d. S. W. Leonard del. Annot. **c** † *Acrodus nobilis* longitudinal section of tooth: 1 w.d. P: *l.c.* pl.15 **e** † *Rhizodus hibberti* longitudinal & transverse section of teeth: 3 w.d. J. Dinkel del. P: *l.c.* pl.36,37 **f** † *Ptychodus decurrens* longitudinal sections of teeth: 3 w.d. J. Dinkel del. P: *l.c.* pl.18,19 **g** [Order unident. ? *Megatherium*] tooth section: 1 w.d. J. Dinkel del.

91 **a** † *Sagenodus inequalis** tooth plate, longitudinal section *No. P6246: 4 c. & black & white d. P: *Trans. odont. Soc. Gr. Br.* **5** 1867 pl.12 **b** † *Characodus confertus* [*Rhizodopsis sauroides*] longitudinal tooth section: 3 c. & monochrome d. P: *l.c.* pl.13 **c** † [*Rhizodopsis sauroides*]* tooth sections: 8 i. & w.d. P: *l.c.* pl.14 in *coll. **d** † *Gastrodus prepositus* [*Rhizodopsis sauroides*]* longitudinal tooth sections P6247: 11 c. & monochrome d. All [T. West del.] P: *l.c.* pl.15

92 **a** † *Mitrodus quadricornis* [*Gyracanthus formosus*]* scale, longitudinal section *No. P6239: 1 c. & 3 monochrome d. T. West del. P: *l.c.* pl.3 **b** † *Agelodus diadema* [*Callopristodus pectinatus*]* tooth, longitudinal section *P6240: 4 c.d. T. West del. P: *l.c.* pl.4 **c** [† Fish unident.] tooth, natural size, lat. & longitudinal section: 2 c.d. L. Aldous del. Annot. **d** † *Oreodus robustus* tooth, longitudinal section: 1 c. & 3 monochrome d. T. West del. Annot.

Folio

93 **a** *Sus scrofa* disarticulated skull & forelimb, r. lat.: 1 p.d. P: Owen, R. *Archetype . . . of the Vertebrate Skeleton* Lond. 1848 f.24 p.128 **b** *Canis* skel. l. lat.: 1 p.d. P: *l.c.* pl.2 f.5

94 **a** *Alligator lucius* [*mississippiensis*] disarticulated cranium, r. lat.: 1 p.d. P: *l.c.* f.22 **b** *Homo sapiens* sk. of newborn child, r. lat. exploded view. 1 p.d. **c** foetal skel. disarticulated sk. r. lat.: 1 p.d. R.O. del. P: *l.c.* f.25

95 **a** *Canis* skel. r. lat.: 1 i. outline d. Annot. P: *l.c.* pl.2 f.5 **b** [Aves unident.] skel. l. lat.: 1 i.d. R.O. del. Annot. P: *l.c.* pl.2 f.4 *Homo sapiens* **c** skel. l. lat. **d** sk. r. lat.: 2 i. outline d. R.O. del. P: *l.c.* pl.2 f.6

96 **a** *Morrhua vulgaris* [*Gadus morhua*] encephalic arch: mesencephalic arch: prosencephalic arch: rhinencephalic arch: All disarticulated & viewed from post. 4 p.d. P: *l.c.* f.1–4 **b** *Crocodilus* [*Crocodylus*] encephalic arches, bones disarticulated, post. view 22 p.d. P: *l.c.* f.18–21 **c** [Aves unident.] thoracic vertebra, ribs & section of sternum: 1 p.d. R.O. del. P: *l.c.* f.15 **d** *Pelecanus* cervical vertebra: 1 p.d. Annot. **e** diagrams of ideal animal & *Homo*, vertebrae showing neural & haemal arches: 2 i.d. R.O. del. Annot. P: Owen, R. *Anat. of Vertebrates* Lond. 1866 **1** f.17,18

97 *Gadus morhua* **a** 13 disarticulated bones: jaws, suspensorium, branchial & hyobranchial skel. **b** 26 disarticulated bones, circumorbital & opercular series. All p.d.

98 *Morrhua vulgaris* [*Gadus morhua*] latero-sensory canal, disarticulated bones: 1 p. & i.d. R.O. del. Annot. P: Owen, R. *Archetype . . . of the Vertebrate Skeleton* Lond. 1848 f.5

99 Archetypes & homologies of the skel. **a,e** reptile **b,d** fish **c,f** archetype, skels. lat. view: 6 p. & i.d. R.O. del. **a** Annot. preliminary d. for *l.c.* pl.2 f.3,2,1.

100 *Homo* from Bruniquel Caves **a** l. frontal fragments of cranial vaults **b** fragments of frontal bone **c** 2 pieces of cranial vault **g,h** endocranial casts, dors. & post. **a** Annot. 6 p.d. **d** letter from A. W. Franks dated 2/4/1864 **e** Bruniquel Caves: 1 photo. **f** *Bos primigenius* head from Bruniquel Caves: 2 p. & crayon d.

101 **a–e** plans of the cavern at Bruniquel, 1864: **c** engr., others i. & wash d. R.O. del. Annot. P: *Phil. Trans. R. Soc.* **159** 1869 f. 1–4

102 **1** † [*Goniopholis tenuidens*]* incomplete lower jaw, with teeth & ant. canine HOLOTYPE *No. 48300 **2** † [*Brachydectes* [*Oweniasuchus*] *major*]* l. ramus, l. lat. HOLOTYPE *No. 48304 **3** † [*Brachydectes* [*Oweniasuchus*] *minor*]* l. ramus, l. lat. *No. 48328b **4–12** † [Crocodilia, unident.] parts of vertebrae **13** † [*Brachydectes* [*Oweniasuchus*] *minor*]* 3 dors. vertebrae, lat.: *No. 48335a. 14 p.d. H. Olson del. P: Owen, R. *Brit. Fossil Reptiles* Lond. 1849–84 Crocodilia pl.42

103 † *Teleosaurus chapmani* [*Plesiosaurus brongniarti*]* incomplete skel. in slab, dors. & lower jaw, vent.: 2 p.d. [J. E. Giradot del.] P: *l.c.* pl.15 f.1 2 *No. 14792

104 **a,b** † [Plesiosaurian] incomplete post-cranial skel. in block: 2 photos. Annot. **c** † *Ichthyosaurus cuvieri* incomplete sk. & cervical vertebrae, l. lat. 1 photo. Annot.

105 **a** † *Ichthyosaurus communis* skel. in slab, vent.: 1 photo. Annot. **b** † *Ichthyosaurus* skel. in slab: 1 photo. **c** † *Ichthyosaurus tenuirostris* skel. in slab: 1 p.d. I. I. Walker del. Annot.

106 **a** † *Ichthyosaurus communis** skel. of young in slab, l. lat. *No. 36256 **b,c** † [*Ichthyosaurus communis*]* skel. in slab, vent. P: Owen, R. . . . *Reptilia . . . Liassic Formations* Pt. 3 *Palaeontogr. Soc.* (*Monogr.*) 1881 pl.30 f.3 *No. 38803 **d,e** † *Ichthyosaurus latifrons* skel. in slab, l. lat. P: *l.c.* pl.23 f.6, pl.32 f.9 *No. 38709. 5 photos

107 **a** † [*Ichthyosaurus acutirostris*]* incomplete skel. in matrix: 1 photo. *No. 14553 **b** † [*Ichthyosaurus acutirostris*]* sk. in slab, dors. *No. 15500a **c** † *Ichthyosaurus latifrons** imperfect skel. in slab, dors.: P: *l.c.* pl.32 f.8. *No. 14566 **d,e** † *Ichthyosaurus longirostris** skel. in slab, l. lat.: P: *l.c.* pl.32 f.7. *No. 36182 † *Ichthyosaurus platyodon** **f1** skel. in slab, dors.: P: *l.c.* pl.31 f.1. *No. 2003 **f2** vertebral column with restorations of vertebrae *No. 481. 5 photos

108 **a,b** † *Ichthyosaurus tenuirostris** skel. in slab, dors. P: *l.c.* pl.32 f.1. *No. R 1120 **c,d** † *Ichthyosaurus communis** skel. of young in slab, r. lat. *No. 120 **e** † *Ichthyosaurus breviceps** skel. in slab, l. latero-dors. P: *l.c.* pl.29 f.2. *No. 43006. 6 photos

109 **a1** † *Ichthyosaurus*, **2** † [Archosaurian], **3** † [Unident], **4** † [Plesiosaurian] vertebrae: 8 wash d. Annot. **b** † ?Ichthyosaurian, caudal vertebrae: 2 wash d. T. L. Shuckard del. Annot. **c** † *Ichthyosaurus tenuirostris* or *I. acutirostris* fragments of sk. in slab: 11 p.d. C. Theodori del. Annot. **d** † *Ichthyosaurus tenuirostris* skel. fragments in slab: 1 p.d. C. Theodori del. Annot.

110 **a** † *Ichthyosaurus* vertebra, 2 views: 2 s.d. Annot. **b** † [*Ichthyosaurus*] 4 vertebrae in slab: 1 s.d. H.S. del. **c** † *Thyreo-spondylus* [*Ichthyosaurus thyreospondylus*] vertebra, incomplete, 3 views: 3 w.d. C. [Clift] del. **d** † *Ichthyosaurus trigonus* vertebra, 3 views: 3 w.d. H.S. del. Annot. **e** † [Unident.] 2 vertebrae in slab, lat. section: 1 w.d.

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111 **a** † *Ichthyosaurus platydon* scapula: C. [Clift] del. **b** † *I. tenuirostris*? propodials, incomplete: G.S. del. Annot. **c** † *I. tenuirostris*? scapula: Annot.: 4 w.d.

112 **a** † *Ichthyosaurus tenuirostris* fragments of vertebrae, ribs & propodial in slab: 1 w.d. **b,e** *Ichthyosaurus* **c** *I. intermedius* **d** † *I. tenuirostris*: propodials: 4 w.d. Annot.

113 **a** † [*Ichthyosaurus*] propodials: 2 w.d. W.C. del. Annot. **b** † [*Ichthyosaurus*] propodials: 1 i.d. Annot. **c** † [*Ichthyosaurus*] propodial: 1 i.d. Annot.

114 **a,b** † *Ichthyosaurus* propodials: 5 rough p. sketches for Fol. 113. Annot.

115 **a** † [Unident. ? *Ichthyosaurus*] part of pectoral girdle: 1 wash d. **b** † [Unident. ? *Ichthyosaurus*] part of pectoral girdle, frontal: 1 p. & wash d. **c** † [*Ichthyosaurus*] pectoral girdle, incomplete, frontal: 1 p. & wash d. Annot. **d** † [Ichthyosaurian] incomplete pectoral girdle in slab, frontal: 1 wash d. Annot.

116 **a** † *Ichthyosaurus* sternal ribs in slab: 1 w.d. **b** † *Proteosaurus* [*Ichthyosaurus*] incomplete skel. 1 s.d. W.C. Junior del. Annot.

117 † [Ichthyosaurians] **a** incomplete sk. l. lat.: 1 w.d. Annot. **b** incomplete sk. with matrix, dors.: 1 w.d. G. Cumberland del. Annot. **c** incomplete sk. l. lat.: 2 w.d. Annot.

118 † [Ichthyosaurians] **a** part of sk. r. lat.: Annot. **b** part of sk. r. lat. G. Cumberland del. Annot. **c** sk. nearly complete, l. lat.: Annot. 3 w.d.

119 † [Ichthyosaurians] **a** incomplete sk. l. lat.: Annot. **b** incomplete sk. r. lat.: Annot. **c** incomplete sk. l. lat.: Annot. 3 w.d.

120 † *Proteosaurus* [*Ichthyosaurus*] imperfect skel.: 1 w.d. Annot.

121 † *Ichthyosaurus* [*intermedius*] imperfect skel. in slab, l. lat.: 1 i.d. J. Dinkel del. Annot.

122 † *Ichthyosaurus* **a** imperfect rostrum **b** vertebrae **c** propodials **d** pectoral girdle: 10 s.d. [All parts of specimen figured on Fol. 121] Annot.

123 **a** † [Ichthyosaurian] incomplete skel. in slab: l. lat. & 4 separate vertebrae: 5 i. sketches. Annot. **b** † *Ichthyosaurus tenuirostris* incomplete skel. in slab: 1 i. sketch. Annot. **c** † [Ichthyosaurian] restored sk. & lower jaw, including sections: 12 i.d. H. de la Beche & W. D. Conybeare del. P: *Trans. geol. Soc. Lond.* **5** 1821 pl.40

124 **a** † *Placodus bathygnathus* [*gigas*]* incomplete l. ramus & teeth, lat. & occ.: 3 i. outline d. P: *Phil. Trans. R. Soc.* **148** 1858 [1859] pl.11 f.1–3 HOLOTYPE of *P. bathygnathus* *No. 19677 **b** † *Placodus* [*Cyamodus*] *rostratus* pal. view of incomplete sk. with dentition: 1 p.d. P: *l.c.* pl.1 f.4 **c** † *Placodus* [*Cyamodus*] *laticeps** pal. view of sk. with dentition: 1 p. sketch. lithograph P: *l.c.* pl.10 f.1. HOLOTYPE *No. R 1644

125 **a** † *Placodus* [*Cyamodus*] *laticeps* & *P. bombidens* [*andriani*]* parts of upper & lower jaws: 11 p.d P: *l.c.* pl.9 f.3–6 & pl.10 f.2–7. Pl.9 f. of *No. R 1643 HOLOTYPE of *P. bombidens* **b** † *Placodus* [*Cyamodus*] *laticeps** sk. dors. & lat.: 2 p. sketches P: *l.c.* pl.9 f.1–2 HOLOTYPE *No. R 1644

126 † *Pliosaurus* ? **a** propodials & ischium: 1 photo. Annot. **b** † *Plesiosaurus dolichodeirus* pectoral girdle: 1 i. & wash d. R.O. del. Annot. P: Owen, R. *Hist. Brit. fossil Rept. Lond.* 1849–84 **4** pl.20 f.1

127 † *Pliosaurus brachydeirus* incomplete lower jaw, occ.: 1 i. & wash d. H. de la Beche del. Annot. HOLOTYPE Oxford Univ. Mus. Geol. Coll. No. J 9245 B

128 † *Plesiosaurus giganteus* [*Pliosaurus brachydeirus*] incomplete sk. pal. & dors.: 3 i. & wash d. H. de la Beche del. Annot. Oxford Univ. Mus. Geol. Coll. No. J 9245 A

129 † *Polyptychodon* **a** tooth, 3 views: 3 w.d. Annot. **b** tooth: 2 sepia d. Annot. **b1** P: Owen, R. . . . *Reptilia* . . . *Cretaceous formations. Palaeontogr. Soc.* (*Monogr.*) 1851 pl.14 f.5 **c** tooth, 3 views: 3 s.d. **d** † [Pliosaurian] tooth, 3 views: 3 s.d. H.S. del. Annot. **e** † [? Pliosaurian] tooth, 4 views: 4 p.d. Annot. **f** † *Polyptychodon* worn tooth: 2 w.d. Annot. **g** † *Pleiosaurus* [*Pliosaurus brachydeirus*] tooth, 2 views: 2 w.d. Annot. **h** † Saurian teeth 2 p.d. Annot. **i** † [Pliosaurian] tooth: 1 p. sketch. Annot. **j** † [? *Polyptychodon*] tooth in block: 1 c.d. Annot.

130 **a** † [Pliosaurian] cervical vertebra, lat.: 1 c.d. **b** † [? *Plesiosaurus*] vertebra, 2 views: 2 s.d. Annot. **c** † [Pliosaurian] cervical vertebra end view: 1 w.d. **d** † *Plesiosaurus hawkinsii* post. half of sk. vent.: 1 w.d. G.S. del. Annot. **e** † *Pectopleuron* [? Plesiosaurian] cervical vertebra, 2 views: 2 w.d. Annot.

131 **a** † *Plesiosaurus* [*Thaumatosaurus*] *arcuatus* vertebra, end view. *P. hawkinsii** 2 vertebrae, lat. *No. 2020 † *Plesiosaurus* caudal vertebrae, diagram 7 p.d. & sketches. Annot. P: *Trans. geol. Soc. Lond.* Sec.2 **5** 1838 pl.44 figs 4,5,6 **b** † [*Plesiosaurus carinatus*] cervical vertebra, 3 views: 3 w.d. C. [Clift] del. Annot. **c** † [*Plesiosaurus*] *perforatus* [*carinatus*] cervical vertebra: 3 w.d. C. [Clift] del. Annot. [? TYPE of *Pl. carinatus* Phillips, J. 1871]

132 **a,b** † *Plesiosaurus subdepressus* vertebra, 3 views: 3 s. wash d. Annot. **c** † *Plesiosaurus* vertebrae, lat.: 1 i. & wash d. Annot. **d** † [*Plesiosaurus*] *compressus* vertebra, 2 views: 2 w.d. Annot.

Folio

133 **a–d** † *Plesiosaurus costatus* [*carinatus*] vertebrae: 8 c.d. C. [Clift] del. Annot.

134 **a** † *Plesiosaurus subcavatus** vertebra, 2 views: 2 s.d. H.S. del. Annot. *No. 16058 † *Plesiosaurus laticeps* [? Plesiosaurian] **b** vertebra & teeth in matrix **c** 6 vertebrae, lat. **b,c** 4 c.d. Both Annot.

135 **a–c** † *Plesiosaurus subtrigonus* cervical vertebra, 3 views: 3 w.d. C. [Clift] del. Annot.

136 **a** † *Plesiosaurus* [*Pliosaurus*] *brachyspondylus* vertebra, 3 views 3 w.d. C. [Clift] del. Annot. **b** † *Plesiosaurus* [*Pliosaurus*] *brachydeirus* vertebra, 2 views: 2 p.d. Annot.

137 **a** † *Plesiosaurus homalospondylus** caudal vertebrae, 2 views: 2 i. & w.d. Annot. *No. R 1367 **b** † *Plesiosaurus** vertebra, lat.: 1 s.d. 2 p. sketches. Annot. **c** † *Plesiosaurus concavus* [Plesiosaurian]* vertebra, lat.: 1 s.d. Annot.

138 **a** † *Pl*[*esiosaurus*] *dibothrius* cervical vertebra: 2 views 2 c.d. E. G. Müller del. Annot. **b,c,** † *Plesiosaurus* vertebrae, dors. & cervical: 2 s.d. Annot. **d** † *Plesiosaurus rugosus* vertebrae, 2 views: 2 s.d. G.S. del. Annot.

139 † *Plesiosaurus macrocephalus** incomplete skel. in slab, dorso-lat.: 1 w.d. J. Dinkel del. P: *Trans. geol. Soc. Lond.* (2) **5** 1838 pl. 1838 pl.43. HOLOTYPE *No. R 1336

140 † [Unident. ? reptile or mammal] incomplete skel. as found showing parts of vertebral column, cranium & limbs, l. lat.: 1 rough w. sketch

141 **a,b** † *Thecospondylus horneri** sacral vertebrae, lat., vent.: 2 p. sketches. A. C. Horner del. Annot. Fig: *Q. Jl geol. Soc. Lond.* **38** 1882 pl.19 f.1,2. HOLOTYPE *No. R 291

142 † *Iguanodon* metacarpals [?] **a** end view **b** 3 views: 4 p. sketches. Annot.

143 † [*Iguanodon*]* 2–4th digits of hind foot: 1 p.d. Annot. *No. R 1829. Fig.: Owen, R . . . *Reptilia Wealden Formations* Suppl. 1 *Palaeontogr. Soc.* (*Monogr.*) 1858 pl.1

144 † [*Megalosaurus* or *Hylaeosaurus*]* **a** 3 bones [? metatarsals]: 1 w.d. Annot. **b** terminal phalanges: 2 w.d.

145 **a** † [? Crocodilian.] 2 bones, parts magnified 4 s.d. G. B. Holmes del. **b** † *Streptospondylus* [Saurischian] dors. vertebra spinous process, 3 views: 3 s.d. Annot. P: Owen, R. *Hist. Brit. fossil reptiles* Lond. 1849–84 **2** Atlas pl.21, f.3,4,5 **c** † *Streptospondylus altdorpensis* [*major*] [Saurischian] incomplete vertebra, lat. & post.: 2 w.d. C. del. Annot. **top** P: *l.c.* pl.21 f.2

146 **a** † *Streptospondylus* [*Iguanodon*] dors. vertebra, ant. post. lat. dors. & vent.: 5 s.d. Annot. **b,c** † *Streptospondylus major* [*Iguanodon bernissartensis*] * centrum of vertebra, lat. & dors.: 2 c.d. *No. 2239 **b** Annot. **c** P: *l.c.* pl.21 f.6.

147 **a–c** † *Streptospondylus* [*cuvieri*] [? *Eustreptospondylus*] dors. vertebra, post. lat. & ant.: 3 w.d. Ripley del. Annot.

148 **a** † *Iguanodon** ungual phalanx, dors. & lat.: 2 c.d. Annot. P: Owen, R. . . . *Reptilia* . . . *Wealden Formations* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1854, pl.17 f.1,2 *No. 2384 **b** † *Iguanodon* terminal phalanx: 1 photo. Annot. **c** † *Hylosaurus* Qu *Iguanodon* [? *Iguanodon*]* digital bones, 3 views: 3 w.d. R.O. del. Annot. **d** † *Rysosteus* vertebra, lat.: 1 p. & s.d. Annot. **e** † *Scelidosaurus* 3 phalanges, 3 views of each: 9 s.d. Annot. **f** ? † *Scelidosaurus* phalanges, palmar & dors.: 2 p.d. **g** † *Scelidosaurus* [*harrisoni*]* coracoid: 1 p.d. Annot. *No. R 1111

149 **a** † *Omosaurus armatus** imperfect skel. as found: 1 p. sketch Fig: Owen R. . . . *Reptilia* . . . *Mesozoic Formations* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1875 pl.19. *No. 46013 o **b** † *Cetiosaurus brevis** vertebra, antero-lat. & ant. **1** s.d. & **i.** outline. Annot. *No. 2545 **c** † *Cetiosaurus brevis* [? *Pelorosaurus conibeari*]* **c top** 3 chevron bones, 2 incomplete, f.8b *Nos 2548–50 **c middle** centrum, 3 views **c bottom** 4 associated ant. caudal vertebrae, lat.: *No. 2544–2550 Fig. *Phil. Trans. R. Soc.* **140** 1850 pl.22 f.7,8b. HOLOTYPE of *C. brevis* *No. 2544

150 **a–c** † *Cetiosaurus hypöolithicus* bones in situ: 20 p. sketches Annot.

151 **a** † [Saurischia, unident.] 2 teeth & section: 5 s.d. **b** † *Megalosaurus* tooth serrations magnified: 2 s.d. Annot. † *Megalosaurus* [*bucklandi*] **c** incomplete m. & teeth, lat. **e** section B–B of **c** showing teeth: 2 w.d. **c&e** P: Owen, R. . . . *Reptilia* . . . *Wealden Formations* Pt 3 *Palaeontogr. Soc.* (*Monogr.*) 1856 pl.12 f.1,2 **d** part of tooth B of **c&e** showing marginal serrations: 1 i. & wash d. **f** † *Megalosaurus** tibia, 2 views: 2 p.d. Annot. P: *l.c.* pl.9 *No. 31809

152 † *Megalosaurus* [*bucklandi*]* incomplete sk. & lower jaw, l. lat.: 1 engr. J. Erxleben lith. p. additions R.O. del. Annot. P: *Q. Jl geol. Soc. Lond.* **39** 1883 pl.11 f.1,2. Casts – *No. R332, R333

153 **a** † [*Iguanodon*]* tooth, worn stump, in matrix, lat. & occ.: 2 w.d. *No. 2394 **b** † *Hylaeosaurus* [? *Megalosaurus*] scapula [? pubis]: 1 s.d. Miss Holmes del. Annot. P: Owen, R. . . . *Reptilia* . . . *Wealden Formations* Pt 3 *Palaeontogr. Soc.* (*Monogr.*) 1856 pl.5 f.1 **c** † *Hylaeosaurus** osseous remains in slab: 1 c.d. J. Dinkel del. Annot. P: *l.c.* Pt 4 1857 pl.4. HOLOTYPE *No. 3775

154 † [*Iguanodon mantelli*]* osseous remains in slab **a** i. & s. sketch G. Nibbs del. **b** completed c.d. J. Dinkel del. **a,b** both Annot. Maidstone Block *No. 3791

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155 † [? *Iguanodon mantelli*] vertebra, incomplete **a,c** post. lat. & vent.: 3 s.d. Annot. **b** vertebra, incomplete, fronto-lat.: 1 wash d. Annot. **d** vertebra, end view: 1 wash d. **e** † [*Iguanodon mantelli*]* 6 caudal vertebrae on slab & ant. view of single vertebra: 1 c. & 1 p.d. P: *l.c.* Pt 2 pl.8 *No. 3790 **f** † [? *Iguanodon*] caudal vertebra, ant.: 1 i. diagram

156 † [Unident. ? Reptilia] **a** bones on slab: 1 w.d. † [*Cetiosaurus brevis*] vertebrae **b** end & lat. views: 2 s.d. **c–e** end, lat. & dors. views of same bone: 3 w.d. Annot. **f,g** † [Reptilia, unident.] vertebra, incomplete, post. & lat.: 2 w.d. Annot.

157 **a1,5** † [*Hylaeosaurus*]* tibia, 2 views P: *l.c.* Pt 3 1856 pl.5 f.2 *No. 2615. **a2** [? chevron bones] **a3** [Unident.] **a4** [? centrum] Annot. 5 s.d. **b1,6** † [*Hylaeosaurus*]* scapula, 2 views: *No. 2584 **b2,5** ? phalanges **b3,4** centra 6 s.d. † *Iguanodon mantelli* **c** foot bones, 13 views: 12 s.d. & 1 p. outline **d1–4** scapula*, 3 views & sternum*: 4 p.i. & s.d. *Nos. 2196 scapula, 2218 sternum

158 Ornithischia & Saurischia **a1** † [Unident.] phalange, lat. **a2** † [*Megalosaurus dunkeri* [*M. owenii*]]* metatarsals, lat. *No. 2559 **a3** † [Unident.] ?end view of metatarsal in **a2.** **a4** † [? *Megalosaurus dunkeri* [*M. oweni*]] ? end view of **a5.** **a5** † [*Megalosaurus dunkeri* [*M. oweni*]]* 3rd l. metatarsal, lat. *No. 2680 **a6** † [Unident.] phalangeal: **a7,8** † [*Megalosaurus dunkeri* [*M. oweni*]]* ungual, dors. & lat. *No. R 1105 P: Owen, R. . . . *Reptilia . . . Wealden Formations* Pt 3 *Palaeontogr. Soc.* (*Monogr.*) 1856 pl.10 f.2 **a9** † [? *Megalosaurus*]* ? ungual phalanx, lat. ? P: *l.c.* Pt 3 pl.10 f.5 *No. 2402 ? **a11,12** † [*Iguanodon mantelli*]* ungual bone, 2 views ? Fig.: Mantell, G. *Wonders of Geology* Lond. 1839 **1** pl.3 f.2 *No. 3791 † [Unident.] **a10** ? ungual **a13** ungual, vent. **a14** ungual, lat. **a15** ? ungual, vent. **a16** ungual, dors. **a17** phalangeal **a18** † [*Iguanodon*] metatarsal 4, lat. **a19** † [Unident.] ungual, dors. **a** 19 s.d. J. Dinkel del. **b1** † [*Iguanodon*] tooth, marginal serrations: Annot. P: Owen, R. *Odontography* Lond. 1845 pl.62 A f.5 e **b2,3** † [*Iguanodon mantelli*]* lower tooth: 2 views P: Lydekker, R. *Cat. Fossil Rept. Amph.* Lond. 1888 Pt 1 f.37 SYNTYPE *No. 2392 **b4,5** † [*Iguanodon*]* tooth, labial & lingual: *No. 2402 Fig: Mantell, G. A. 1839 *The Wonders of Geology* **1**: 391 Tab. 82 f.4,5 **b6–11** † [? *Iguanodon*] teeth **b12,13** † [*Iguanodon mantelli*]* tooth, 2 views Fig: *Phil. Trans. R. Soc.* **115** 1825 pl.14 f.4a,4b. SYNTYPE *No. 3388 **b14–16** † [*Iguanodon*]* tooth, 3 views: *No. 2394 Fig: Mantell, G. A. 1827 *Illustrations of the geology of Sussex. . . . Fossils of Tilgate Forest* Lond. pl.17, f.2. **b17–19** † [*Iguanodon mantelli*]* tooth, 3 views. **b18** P: Owen, R. *Odontography* Lond. 1840–1845 pl.62A f.5d *No. 2382 **b20** † [Reptilia, unident.] tooth, lat. **b21,22** tooth, transverse section & lat. **b23–27** † [*Megalosaurus bucklandi*] 3 teeth, 5 views **b24–26** includes magn. edge P: *l.c.* pl.62 A f.6a–c **b28–29** † [*Goniopholis crassidens*] tooth, 2 views: **b29** P: *l.c.* pl.62 A f.9 a **b30,31** † [? Crocodile] 2 teeth **b32–34** † [*Hylaeosaurus*] tooth, 3 views **b34** P: *l.c.* pl.62 A f.8 b **b33** P: Mantell, G. A. *Wonders of Geology* Lond. 1839 pl.3 f.6 **b35,36** † [*Crocodilus* (*Suchosaurus*) *cultridens*] tooth, 2 views P: Owen, R. *Odontography* Lond. 1840–1845 Atlas pl.62 A f.10 a,b **b37** † [*Goniopholis crassidens*] tooth P: *l.c.* pl.62 A f.9 b **b** 37 s.d. J. Dinkel del. **c** † [Reptilia, unident.] **c1** vertebra, lat. **c2,3** vertebra, lat. & end **c4,5** vertebra, lat. & ? vent. **c6–9** † *Iguanodon* vertebrae **c10–13** † *Cetiosaurus* vertebrae: 13 s.d. ? J. Dinkel del. **d1** † [*Iguanodon*] medulla, cast **d2–7** † *Poekilopleuron* [*Megalosaurus*] **d2** cervical vertebra **d3,4** vertebra, 2 views: Annot. **d5** centrum **d6,7** vertebra, 2 views: Annot. **d8,9** † [*Cetiosaurus brevis*]* caudal vertebra, vent. & lat. P: *Phil. Trans. R. Soc.* **140** 1850 pl.23 f.10 a–c. *No. 28646. † [Unident. ? Reptilia] **d10,11** sacral vertebra, 2 views **d12–15** 4 vertebrae **d** 15 s.d. [J. Dinkel del.]

159 **a** † [*Iguanodon mantelli*]* bones of Maidstone specimen arranged as plate, some labelled: i. outline d. of 39 bones. *No. 3791 **b** † *Iguanodon* [*mantelli*]* r. femur, distal end, 2 views: 2 s.d. Annot. P: Mantell, G. *The geology of the S.E. of England* Lond. 1833 pl.4 f.3,4. *No. 2674 **c** † *Iguanodon* [*mantelli*]* r. femur in matrix: 1 s.d. Annot. P: Mantell, G. *Wonders of Geology* Lond. 1839 pl.3 f.11. *No. 2649

160 **a1** † [? Archosaurian] centrum **a2,3** † [Crocodilian] os frontis P: Mantell, G. *The geology of the S.E. of England* Lond. 1833 pl.2 f.5,1 & 6 **a4,5** † [*Iguanodon mantelli*]* r. ischium, 2 views: Annot. P: *l.c.* pl.4 f.1,2 *No. 2158 **b1,2** † [*Cylindricodon* [? *Hylaeosaurus*]] 2 teeth: P: *l.c.* pl.2 f.2 & 4 **b3** † [*Megalosaurus dunkeri* [*M. oweni*]]* ungual, lat.: P: *l.c.* pl.3 f.1 *No. R 1105 **b4,5** [*Iguana*] claw & ungual bone which it covered: P: *l.c.* pl.3 f.2,3 **b6** † [? Reptilia] incomplete bone in matrix **b7,8** † [? *Hylaeosaurus*] ? tibia, 2 views **b9** † [*Iguanodon*] phalange **b10** [? Reptilia] terminal phalange with sheath on matrix **b11** † [*Iguanodon*] sternum P: *l.c.* pl.3 f.4 **b** 11 s.d. All G. Mantell del. **c1,2** † [*Iguanodon mantelli*]* r. fibula, 2 views: Annot. **c1** P: *l.c.* pl.2 f.7. *No. 2677 **c3** † [? *Hylaeosaurus oweni*]* r. ilium on matrix P: *Q. Jl geol. Soc.* **44** 1888 p.53 f.3. *No. 2150 **a–c** 19 s.d. G. Mantell del.

161 † [*Iguanodon*] **a1** incomplete tooth in matrix **a2** ungual phalange*: Fig. as 'horn': Mantell, G.

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The geology of the S.E. of England Lond. 1833 pl.3 f.5 *No. 2384 **a3** ? chevron bone **a4** [Unident.] bone **a5** † [*Cetiosaurus brevis*]* centrum, lat. in matrix: P: *l.c.* pl.2 f.5 *No. 2239. SYNTYPE of *Ornithopsis hulkei* [*Hoplosaurus armatus*] also HOLOTYPE of *Bothriospondylus elongatus* & Fig. Owen, R. . . . *Reptilia* . . . *Mesozoic Formations* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1875 pl.7 **b1,2** † *Iguanodon** tibia, 2 views **b2** P: Mantell, G. *The geology of S.E. England* Lond. 1833 pl.2 f.8 *No. 2678 **b3** † [? *Hylaeosaurus*] end of long bone: All Annot. with measurements **c1** † [*Iguanodon*] rib, incomplete **c2** scapula: Annot. **a–c** 10 s.d. All G. Mantell del.

162 † *Iguanodon* **a,b** r. ramus of young specimen, labial & lingual, **c** same specimen, occ. & vent.: 4 s.d. [Miss Holmes del.] P: Owen, R. . . . *Reptilia* . . . *Wealden Formations* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1854 pl.11 f.1,2; pl.12 f.3,4. Annot. Booth Mus. of Nat. Hist. specimen

163 † [? Reptilia] **a** Cuckfield bone in matrix with magn. part: 1 s.d. [Miss Holmes del.] Annot. **b** vertebral centra, 7 views: 7 s.d. & 6 p.d. Annot. **c** † *Iguanodon* caudal vertebra, 5 views: 5 s.d. [Miss Holmes del.]. Annot. lithographs P: *l.c.* pl.9 f.1–5 † *Iguanodon* [*mantelli*] **d** scapula, humerus & coracoid: 6 s.d. [Miss Holmes del.] P: *l.c.* pl.14 f.1–6. Annot. **e** fibula, 6 views: 6 s.d. [Miss Holmes del.] P: *l.c.* pl.15 f. 3–7. Annot. **f**† [*Iguanodon*] post. caudal vertebra, dors. lat. & vent.: 3 s.d. & 3 outlines. Annot. **d&e** Booth Mus. of Nat. Hist. specimens

164 **a** † *Oudenodon bainii** sk. lat. 1 i. outline d. P: Owen, R. *Palaeontology*, Edinburgh 1861 f.96 & *Q. Jl geol. Soc. Lond.* **16** 1860 pl.1 f.1 HOLOTYPE *No. 36232 **a2** † *Dicynodon* (*Ptychognathus*) *verticalis* [*Lystrosaurus murrayi*]* incomplete sk. in matrix, r. lat.: 1 i.d. P: *l.c.* pl.1 f.2. *No. 36224 HOLOTYPE of *P. verticalis* **b** † [*Dicynodon testudiceps*]* incomplete cranium, 2 views [? pal. & lat.] 2 preliminary p. sketches P: *Trans. geol. Soc. Lond.* (2) **7** 1856 pl.5 f.1. Annot. HOLOTYPE *No. 47051 **c** † *Dicynodon* (*Ptychognathus*) [*Lystrosaurus*] *declivis** incomplete sk. r. lat.: 1 i.d. Annot. P: *Q. Jl geol. Soc. Lond.* **16** 1860 pl.1 f.3. HOLOTYPE *No. 36221 **d** † *Dicynodon lacerticeps** incomplete sk. & ramus, lat. & dors.: 2 i. outlines. Annot. P: *Trans. geol. Soc. Lond.* (2) **7** 1856 pl.3,4. HOLOTYPE *No. 36233

165 **a** *Lacerta agilis* incomplete skel. dors. pelvic girdle: 2 i.d. J. Dinkel del. **b** [? *Varanus*] hyoid apparatus: 1 c.d. Annot. **c** *Tupinambis* sk. & lower jaw, r. lat.: 1 i.d.

166 **a** † *Macellodus brodiei* individual teeth & incomplete dentary: 4 w.d. & lithograph **b** † *Macellodus brodiei* individual teeth, parts of ramus & ? vertebra: 7 w. & p.d. Annot. **left** P: Owen, R. . . . *Reptilia* . . . *Wealden Formations* Pt 5 *Palaeontogr. Soc.* (*Monogr.*) 1861 pl.8 f.10 **c** † [*Echinodon* [*Saurechinodon*] *becklesi*]* individual teeth & parts of upper & lower jaws in matrix: 8 w.d. Annot. P: *l.c.* pl.8 f.1,2,6,7,8. *No. 48214 **d** † [? Thecodont] dentary & teeth of r. ramus & 2 individual teeth, lat.: 4 w.d., 5 p. sketches G.S. del. Annot. **e** † *Rhincosaurus* [*Rhynchosaurus*] sk. fragment: 1 p.d. **f** † Wealden lizard [Unident.] vertebral fragments: 3 w.d. Annot. **g** † [? Mammalia] femur in matrix: 1 w.d. Annot. **h** † *Rhincosaurus* [*Rhynchosaurus*] ant. part of sk. r. lat.: 1 w.d. **i** † [Vertebrate ? Reptilia] bone fragments in matrix: 1 w.d. Annot.

167 **a** † [Mosasauridae] teeth & transverse section: 5 w.d. Annot. **b** † *Coniosaurus* [*Coniasaurus*] incomplete skel. in matrix: 1 i.d. Annot. **c** † *Mosasaurus* dentary, lat.: 1 i.d. **d** † *Liodon anceps* tooth, transverse section, magn. 1 c.d. S. W. Leonard del. **e** † *Dolichosaurus longicollis** vertebral column in matrix: 1 w.d. P: *Trans. geol. Soc. Lond.* **6** 1842 pl.39 f.4. *No. 32268

168 **a** † *Protorosaurus speneri* skel. in matrix: 1 c.d. J. Dinkel del. Annot. Described in Dobson, J. *Desc. Cat. Physiol. Ser. in Hunterian Mus. R. Coll. Surgeons of England.* Lond. 1971, p.215 Cat. No. 308 **b** † *Leptopleuron* [*elginense*]* 4 incomplete skel. in blocks: 4 c.d. J. Dinkel del. Annot. P: *Q. Jl geol. Soc. Lond.* **8** 1852 pl.4 Cast *No. 28244

169 **a** [*Chamaeleo*] 2 animals in bush: 1 w.d. Zeitter del. Annot. **b** [Chameleon] head with tongue extended & forelimb, l. lat.: 1 p.d. R.O. del. Annot. **c** *Ceratophora aspera* head, l. lat. **d** *Ceratophora stoddartii* head, r. lat. **e** *Phrynosoma regale* [*solare*] head, frontal. **c–e** 3 c.d. A. B. W. del. Annot. P: *Phil. Trans. R. Soc.* **171** 1880 pl.37 f.5–8 **f** *Moloch horridus* caudal horns, dors. lat. & vent.: 3 p.d. P: *l.c.* **172** 1881 pl.66 f.4–6. Annot. **g** *Moloch* [*horridus*] vertebrae, lat. dors. & ant.: 3 c.d. Annot. P: *l.c.* **171** 1880 pl.34 f.3,4 **h** *Moloch horridus* **h2** ? head **h3,4** sk. dors. & vent. **h5** sk. frontal **unnumbered** sk. oblique & vent.: 6 w.d. G. M. W. & A. B. W. del. Annot. P: *l.c.* pl.37 f.2–5 **i–j** *Siren lacertina* diss. of hearts: 2 w.d. R.O. del. P: *Trans. zool. Soc. Lond.* **1** 1835 pl.31 f.2,3

170 **a–c** *Lacerta agilis* diss. vent. to show internal anatomy of ♀ & ♂: 3 w.d. I. G. C. or I. S. C. del. Annot.

171 **a** † *Glyptodon asper* caudal segment showing exo- and endoskeleton, ant.: 1 p.d. Annot. P: *Phil. Trans. R. Soc.* **172** 1881 pl.65 f.5 **b** † [*Megalania prisca* [Marsupialia unident.]] metapodial, 4 views: 4 s.d. Annot. P: *l.c.* **177** 1886 pl.14 f.5–8 [see also Smith Woodward *Ann. Mag. nat. Hist.*

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(6) **1** 1888:89] **c** † *Meiolania platyceps* bone fragments: 1 p.d. Annot. **d–f** † [*Meiolania*] pelvic bone, 3 views: 3 p.d. Annot. P: *l.c.* pl.32 f.1–3 **g** † [*Meiolania platyceps*]* tail: 1 p.d. Annot. *No. R679 **h** † [*Meiolania minor*] occipital segment of sk. post.: 1 p.d. Annot. P: *l.c.* pl.29 f.1 **i** † *Meiolania* sk. part: 1 p.d. Annot. **j** † [*Megalania prisca* [Marsupialia unident.]] metapodials & phalanges: 10 s. & i.d. some P: *l.c.* pl. 15 f.10–18 **b&j** M3659–60

172 † [*Megalania prisca* [*Meiolania oweni*]]* **a** caudal segment, ant. plus other fragments: 1 photo. **b** tail, 4 terminal exoskeletal segments, dors. **c** as **b** lat.: 2 photos. Drawings based on these P: *l.c.* **179** 1888 pl.64,65 **a–c** *No. R 392 **d,f** [† *Meiolania platyceps*]* terminal caudal segments, lat.: 3 photos. Drawings based on **e,f** P: *l.c.* pl.37 f.2,1 **e** Annot. **g** exo- and endoskel. of caudal segment, ant.: 1 photo. **d–g** *No. R 908

173 **a–d** † *Megalania* [*Meiolania oweni*]* parts of caudal vertebra: 4 photos **a,c** Fig. *l.c.* **171** 1880 pl.37,38. *No. R 391

174 **a** † *Megalania prisca* [*Meiolania oweni*]* caudal segment showing exo- & endoskel. parts, ant.: 1 w.d. J. Erxleben del. P: *l.c.* **172** 1881 pl.64. *No. R 392 **b** † [*Meiolania platyceps*]* incomplete sk. post.: w.d. P: *l.c.* **179** 1888 pl.34 Cast *No. R 907

175 † *Megalania prisca* [*Meiolania oweni*]* 4 terminal exoskeletal segments of tail, lat.: 1 wash d. J. Erxleben del. P: *l.c.* **172** 1881 pl.65 f.1. *No. R 392

176 † *Megalania prisca* [*Meiolania oweni*]* terminal exoskeletal segments of tail, dors.: 1 wash d. J. Erxleben del. P: *l.c.* pl.65 f.2. *No. R 392

177 † *Megalania prisca* [*Meiolania oweni*]* terminal exoskeletal segments of tail, vent.: 1 wash d. J. Erxleben del. P: *l.c.* pl.65 f.3. *No. R 392

178 † *Megalania prisca* [*Meiolania oweni*]* caudal vertebra oblique dors.: 1 c.d. ?P: *l.c.* **171** 1880 pl.37 f.1. *No. R 391

179 **a** † *Belodon kapffi* [*Phytosaurus cappfi*] sk. & m. 1. lat.: 1 photo by G. Wolf **b,c** *Crocodilus suchus* [*Crocodylus niloticus*] sk. dors. & pal.: 2 s.d. Annot, P: Owen, R. . . . *Reptilia . . . London Clay* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1850 pl.1 f.1,2

180 † *Teleosaurus* **a** vent. scutes **b** vertebral column, ribs & scutes: Annot. **c** † *Teleosaurus cadomensis* ? occipital region **d** † *Teleosaurus gracilis* [*Aeolodon priscus*] fragment of occipital region, scutes & bones **e,f** † *Teleosaurus* [*cadomensis*] sk. dors. & vent.: Annot. 6 pen & w.d.

181 **a** † *Teleosaurus* [*Steneosaurus*] atlas vertebra, 2 views: 2 s.d. Annot. **b** † *Teleosaurus* [*Steneosaurus chapmanni*] sk. vent.: 1 w.d. Annot. **c** † *Teleosaurus* vertebra, l. lat.: 1 s.d. Annot. **d** † *Teleosaurus* [*Steneosaurus*] *latifrons* sk. & m., ant. parts: 4 i. & w.d. Annot. **e** † *Teleosaurus gracilis* sk. & m. on slab, ant. portion, l. lat.: 1 p.i. & w.d. Annot.

182 *Crocodilus* [*Crocodylus*] **a,c,d,e** vertebrae, lumbar, dors. & cervical: 5 outline d. Annot. **b** sk. showing elements, l. lat.: 1 c.d. P: Owen, R. *Anatomy of Vertebrates* Lond. 1866 **1** p.145 **f** [?*Crocodylus*] complete animal, l. lat.: 1 p. & w.d. C. H. S. del. Annot.

183 † *Crocodilus* [*Crocodylus*] **a** vertebra, sacral **b** vertebra, 2 views: 3 w.d. Annot. **c** *C. biporcatus* caudal vertebra, lat. & vent.: 3 w.d. G.S. del. Annot. **d** † *Teleosaurus* [*Steneosaurus*] & *Stenosaurus* vertebrae: 8 p. & wash d. Annot.

184 **a** † *Crocodilus* [? *Diplocynodon*] jaw, lat.: 2 i.d. A. P. Falconer del. Annot. **b** † *Crocodilus hastingsiae* [*Diplocynodon hantoniensis*] pterygoid region: 1 p.d. P: Owen, R. . . . *Reptilia . . . London Clay* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1850 pl.6 f.3 **c,d** † Crocodile lower m. & tooth, l. lat. & occ.: 4 p.d. Annot.

185 **a,b** † [? *Crocodilus hastingsiae* [*Diplocynodon*] *hantoniensis*] ? post. view of cranium: 2 w. & p.d. *cf. l.c.* pl.6 f.2 **c** † *Goniopholis* [*crassidens*] incomplete lower m. occ.: 1 p.d. Annot. P: Owen, R. . . . *Reptilia . . . Wealden Formations* Suppl. 8 *Palaeontogr. Soc.* (*Monogr.*) 1878 pl.1 f.5

186 † *Teleosaurus* [*Steneosaurus*] *chapmanni* **a** vertebrae **b** incomplete sk., dors.: 3 pen & w.d. Annot.

187 † *Teleosaurus latifrons* [? *Steneosaurus*] **a,b,d,e** sk. & lower m. ant. portion, lat. & dors. & sections: 8 pen & wash d. T. L. Shuckard del. Annot. **c** † ? *Teleosaurus* lower m. of young ? 1 pen & wash d. Annot.

188 † *Teleosaurus latifrons* [? *Steneosaurus*] sk. ant. part, dors. & vent. & sections: 5 pen & wash d. T. L. Shuckard del. Annot.

189 [Crocodilia] **a** [Unident.] diss. 1 p. & wash d. Annot. **b** *Crocodilus* [*Crocodylus*] *niloticus* glottis, closed & open: 2 c.d. R.O. del.

190 † Crocodile ant. part of maxilla, pal. dors. & lat.: 1 engr. De la Beche del., C. H. Hullmandel lith. Annot.

191 **a** *Crocodilus biporcatus* [*Crocodylus porosus*] section of sk. to show tympanic cavity: 1 p.d. P: *Phil. Trans. R. Soc.* **140** 1850 pl.41 f.4 **b** *Gavialis gangeticus* vertical section of sk.: 1 p.d. P: *l.c.*

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pl.42 f.9 **c** *Crocodilus* [*Crocodylus*] *acutus* sk. diss. showing emergence of endocarotids: 1 prelim. p. & c. sketch. P: *l.c.* pl.40 f.3 **d** *Crocodilus biporcatus* [*Crocodylus porosus*] vertical section of cranium: 1 p.d. P: *l.c.* pl.42 f.8 **e,f** *Crocodilus* [*Crocodylus*] *acutus* **e** part of cranium & vertebral column, diss. of injected preparation to show carotids: 1 p. & c.d. P: *l.c.* pl.40 f.2 **f** diss. of cranium to show eustachian canals: 1 p.d. P: *l.c.* pl.41 f.7 **g** *Crocodilus biporcatus* [*Crocodylus porosus*] sk. basal portion showing foramina: 1 p.d. P: *l.c.* pl.40 f.1 **h** *Alligator lucius* [*mississippiensis*] palate, section, 2 views: 2 p.d. P: *l.c.* pl.41 f.5,6

192 **a** *Crocodilus* [*Crocodylus*] *acutus* loop of trachea: 1 p. sketch R.O. del. **b** *Crocodilus* [*Crocodylus*] heart diss.: 3 c.d. R.O. del. Annot. P: Owen, R. *Anatomy of Vertebrates* Lond. 1866 **1** f.339,340 **c–e** autograph description of parts of heart

193 **a,b** † *Goniopholis crassidens** skel. remains in blocks: 2 i. sketches G. Nibbs del. Annot HOLOTYPE *No. 3798

194 **a,b** † *Goniopholis crassidens** skel. remains in blocks: 2 c.d. J. Dinkel del. Annot. P: Mantell, G. A. *Wonders of Geology* Lond. 1839 pl.1. HOLOTYPE *No. 3798 & 3799

195 † *Crocodilus* [*Crocodylus*] *physiognathus* **a** sk. pal. **b** l. lower ramus, post. portion, lat. **c** l. lower dentary, labial **d** entire l. ramus, labial: 4 photos of d. O. Roland del. Annot.

196 **1,2** † [*Steneosaurus*] 2 sk. dorso-lat. **3,4** † [Crocodilia] incomplete lower jaw, vent.: incomplete sk. pal. **5,6** † [*Goniopholis*] ant. ends upper jaws, pal. **7** † [Reptilia unident.] ant. ends of jaws with teeth, l. lat.: 7 p.d. Kaup del.

197 *Crocodilus* [*Crocodylus*] *acutus* sk. sagittal section, l. lat.: 1 p.d. P: Owen, R. & Bell, T. . . . *Reptilia . . . London Clay* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1849 f.10 p.25

198 † *Crocodilus hastingsiae* [*Diplocynodon hantoniensis*]* **a** sk. ant. portion, dors. **b** sk. ant. portion & m. r. lat. **c** sk. as **b** l. lat.: 3 p.d. J. Erxleben del. P: *l.c.* pl.6 f.1; pl.7 f.1. *No. 30393 – one of the SYNTYPES of *C. hastingsiae*

199 † *Crocodilus hastingsiae* [*Diplocynodon hantoniensis*]* sk. part, pal.: 1 p.d. P: *l.c.* pl.7 f.2. *No. 30393 – one of the SYNTYPES of *C. hastingsiae*

200 **a** † *Pterosaurus* [Pterosaurian unident.] individual bones: 32 p.d. Annot. **b** † [*Dimorphodon macronyx*] sk. l. lat.: i. outline d. ? orig. d. for reconstructed sk. P: Owen, R. . . . *Reptilia . . . Liassic Formations* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1870 pl.20 † [Pterosaurian] **c** incomplete dentary, lat.: Annot. **d** incomplete dentary & ? jaw fragment, lat.: Annot. **e** same as **d** occ.: Annot. **f** part of lower jaw: Annot. **g** reconstructed lower jaw, occ. & fragments. Annot. All p.d. **h1–6** † [*Pterodactylus sedgwickii*] 1–5 views of same cervical vertebra **h7–12** † [*Pterodactylus fittoni*] cervical vertebrae **h13–14** † *P. sedgwickii* **h15–21** † *Pterodactylus* dors. vertebrae **h22** [*Aptenodytes patachonica* [*patagonica*]] 4th dors. vertebra **h23** † *Pterodactylus bucklandi* rib **h24–26** † [*P. sedgwickii*] sacral vertebrae **h27** † [*P.* indet.] centra & sacral vertebrae **h28–31** † [*P. sedgwickii*] atlas & axis vertebrae **h32–34** † [*P. fittoni*] atlas & axis vertebrae **h35** † [*P. sedgwickii*] ant. caudal vertebra **h36** missing **h37–39** † [*P. bucklandi*] cervical vertebra, 3 views: 39 w.p. & i.d. R.O. & J. Dinkel del. P: *Phil. Trans. R. Soc.* **149** 1859 pl.10 f.1–39

201 **a** † *Pterodactylus raptor** part of ramus in matrix, l. lat.: 1 s.d. Annot. **b** bone surface magnified ×40: 1 s.d. Annot. **c** † *Pterodactylus scolopaciceps* [? *kochi*] specimen in matrix, l. lat.: 1 engr. Annot. **d** † *Pterodactylus* (*Dimorphodon*) *macronyx** sk. & parts of skel. in matrix: 1 w.d. R.O. del. P: Owen, R. . . . *Fossil Reptilia . . . Liassic Formations* Pt 2 *Palaeontogr. Soc.* (*Monogr.*) 1870 pl.17. *No. R 1035

202 **a** † Pterodactyl, 3 bones, lat.: 4 p.d. Annot. **b** † [unident.] ? phalange, lat. & end: 2 p.d. Annot. **c** † ? Pterodactyl ? phalange, lat.: 2 p.d. Annot. **d** [? Pterodactyl] 1st & 2nd phalanges: 4 p. & i.d. Annot. **e** † [? Pterodactyl] bones, lat.: 2 p. & i.d. Annot. **f** † [? Pterodactyl] tibia, oblique: 2 p.d. Annot. **g** † Pterodactyl, ? ischium: 1 p. & w.d. Annot. **h** † Pterodactyl bone, lat. & end: 3 p.d. Annot. **i** † [unident.] ? radius, lat. & end: 4 p.d. Annot. **j** † [unident.] 2 bones: 2 p.d. Annot. **k** † [unident.] 2 bones, lat. & end: 6 p.d. Annot. **l** † Pterodactyl 2 bones: 3 pen, i. & p.d. Annot.

203 † *Ramphorhynchus meyeri* [[*Rhamphorhynchus*] ? *gemmingi*]* vertebrae, hind limbs, lat.: teeth & symphysis of lower jaw, occ.: 1 p.d. P: *l.c.* pl.19 f.5,6 [HOLOTYPE of *R. meyeri* Owen *No. 37003]

204 † *Ramphorhynchus* [*Rhamphorhynchus*] sk. & limb bones in matrix: 1 p. & wash d. Annot.

205 † ? Reptilia impression of footsteps and a fossil reed: 1 engr. (13 f.) Henry Dircks engr. Annot.

206 **a** † Emydian pubis, 2 views: 2 p.d. M. Buckland del. Annot. **b** Autograph description of **a**

207 **a** † [*Saurodesmus robertsoni*]* r. humerus in matrix: 1 w.d. Annot. HOLOTYPE *No. 28877 Fig: Seeley, H. G. *Q. Jl geol. Soc.* **47** 1891 : 168 **b** † ? Crocodile metatarsus in matrix 1 wash d. Annot. **c** † [*Chelonia* [*Eosphargis*] *gigas*] humerus, proximal: 1 c.d. 5 p. sketches. J. S. del. Annot. † *Chelone*

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[*Chelonia*] *mydas*, † *Platemys* [*Emys*] *bowerbankii*, † *Chelonia* original p. sketches for Owen, R. & Bell, T. . . . *Foss. Rept. Lond. Clay* Pt 1 *Palaeontogr. Soc.* (*Monogr.*) 1849 pl.29

208 **a** † *Platemys* [*Emys*] *bowerbankii* scutes: 1 p. sketch R.O. del. original sketch for Owen, R. & Bell, T. *l.c.* pl.23. HOLOTYPE **b** † *Tretosternon punctatum* scutes: 1 s.i. & wash d. C. R. Bone del. Annot. **c** † *Emys testudiniformis** carapace & plastron, incomplete, ant.: 1 p. & wash d. Annot. P: *l.c.* pl.24 f.6. HOLOTYPE *No. 39767 **a** probably lost, see Lydekker 1889 **3** : 171

209 **a** † *Chelonia platygnathus* [? *Lytoloma planimentum*] m. in matrix, vent.: 1 w.d. Annot. **b** † *Chelonia platygnathus* altered to *planimentum** imperfect sk., dors.: 1 w.d. Annot. Cast of HOLOTYPE of *L. planimentum* *No. R 1483 P: *l.c.* pl.9 f.1,2

210 **a** *Chelydra serpentina* [*Chelys fimbriata* [*Chelus fimbriatus*]] heart, diss.: i. & w.d. R.O. del. P: Owen, R. *Anat. of Vertebr.* Lond. 1866 **1** f.336 **b** *Testudo* [*Chitra*] *indica* head, vent. diss. muscles **b verso** head, l. lat.: Annot. **c** [Chelonian unident.] pelvic region muscles, vent. diss. **d** pectoral region muscles, vent. diss.: **a–d** 4 p.d. Annot. **e,f** [Chelonian unident.] complete animal, dorso-lat. & ventro-lat.: 2 c.d.

211 *Chelonia* [*Eretmochelys*] *imbricata* **a,b** gut **c** carapace **d** diss. specimen, vent. **e** plastron, vent. **f** r. forelimb, vent. **g** ventro-lat. **h** r. hind limb, vent.: 8 p.d. **e,g,h** with wash. W.C. del. Annot.

212 **a–g** † *Palaeochelys novemcostatus* sk. & carapace fragments: 7 photos of d. signed O. Roland

213 **a–d** † *Palaeochelys novemcostatus* skel. remains including carapace, dors. vent. & lat.: 4 photos of d. signed O. Roland. Annot. P: description Valenciennes, A. *C. R. Acad. Sci. Paris* **56** 1863 : 317–318

214 † [Chelonian, unident.] carapace & skel. l. lat.: 2 c.d. G.S. del. Annot.

215 **a** *Python* tongue, diss.: 1 p.d. **b** [Unident. ? *Python*] head, myology, lat. vent.: 2 crayon d. **c** [Snake, unident.] urinary system: 1 p.d. Annot. *Python tigris* [*molurus*] **d** head diss., vent.: 1 w.d. R.O. del. **e** head diss. & myology, vent. **f** myology of claspers: both w.d. R.O. del. Annot.

216 **a–d** *Python* heart, 4 diss.: 4 c.d. R.O. del. Annot.

217 **a,b** *Coluber* 2 w. & i.d. **b** Annot. P: Russel, P. *Indian Serpents* Lond. 1801 pl.24,33

218 † [*Coelodonta antiquitatis*]* **a,b** sk. lat. pal. **c** upper tooth row, pal.: 3 p. sketches Annot. *No. 46085

219 † [Plesiosaurian] vertebra, 5 views: 5 p.d. Annot.

220 † [Plesiosaurian] vertebrae & ribs in matrix: 1 p.i. & wash d. on tracing linen. Annot.

221 † [Plesiosaurian] 9 vertebrae: 1 i. & wash d. Annot.

222 **a** † *Coelorhynchus* [*Cylindracanthus*] *rectus* part with 2 outlines of cross-sections **b** † *Pristis lathami* [*bisulcatus*] part in matrix: 2 hand c. lithogr. G. Severyns del. et lith. Annot. **a** Fig. *Encyclopaedia Britannica* Edinburgh 8th ed. **17** 1858 : 128 f.62

223 † [Plesiosaurian] sk. parts with teeth in matrix: 1 wash d. Annot.

224 **a** *Elephas indicus* [*maximus*] & rhinoceros in zoo: 1 i. sketch **b** *Elephas indicus* [*maximus*] r. lat.: 1 wash d.

225 *Homo sapiens* skel. frontal: 1 pen & wash d. Swartzfager del.

226 *Homo sapiens* portraits of heads **a** Antis, Peru, r. lat.: 1 p.d. **b** Durabi, New Guinea: 1 w.d. **c** Indigenous N. American: 1 w.d. **d** Sensi Indian, Peru, l. lat.: 1 w.d. **e** Darnley Islander, New Guinea: l. lat.: 1 w.d. **f** S. American Indian, ? Antis, Peru, l. lat.: 1 p.d.

227 *Homo sapiens* sk. **a** ♂ native Andaman Is. r. lat.: 1 p.d. **bI** Juvenile of Georgia, King George's Sound **bII** Adult of St. Vincent Id, W.I.: lithograph, P. Camper del. J. Newton lith. Annot.

228 *Homo sapiens* **a** sk. artificially deformed, l. lat.: 1 w.d. W.C. del. Annot. **b,c** normal sk. frontal & l. lat.: 2 w.d. W.C. del.

229 *Homo sapiens* from Bellars Nap **a** 2 crania, dors. **b** sk. & lower jaw, r. lat. **c** 5 lower jaws, occ.: 3 photos. Annot. **d** *Homo* from Abbeville, half m. lat.: 1 i. sketch M. O. Dimpre del. Annot. **e** *Homo* cranial vault, l. lat.: **f** *Homo sapiens neanderthalensis* head, 1. lat. Both photos. Annot.

230 *Homo sapiens* cranium, incomplete **a** dors. **b** frontal **c** l. lat.: 3 photos. Brain of microcephalic ♀ 42 years **d** dors. **e** vent.; sk. of above **f** frontal **g** l. lat. **d–g** 4 photos by R. T. Gore Annot. Photos described in *Anthrop. Rev.* **1** 1863 : 168

231 *Macaca nemestrinus* [*nemestrina*] **a** vertebrae, dorsal 10–12 & lumbar 1–4, 1. lat.; vertebrae 10 & 11, dors. view: 3 p.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.45 f.3,4 **b** vertebrae, dorsal 10–12 & lumbar 4, dors.: 1 s.d. P: *l.c.* pl.44 f.2 **c** *Homo sapiens* vertebrae, dorsal 10–12, lumbar 1–3, l. lat.: 1 s.d. P: *l.c.* pl.44 f.1

232 [*Homo sapiens*] **a** tibia & fibula: 1 charcoal & wash. d. Andre del. **b** immature sk. diss. l. lat.: 1 c.d. **c** diss. showing facial nerves l. lat.: 1 w.d. C. Bell del.

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233 [*Pan troglodytes*] **a** party of three: 1 c. engr. G.S. del. & lith. Annot. **b** standing specimen, frontal: 1 engr. B. Gravelot del. Scotin lith. Annot.

234 *Simia* [*Pan*] *troglodytes* **a** skel. of adult, l. lat. Annot. **b** skel. of young, l. lat. Annot. Both p.d. P: *Trans. zool. Soc. Lond.* **1** 1835 pl.48 **c** *Simia satyrus* [*Pongo pygmaeus*] skel. of juvenile, 1. lat.: 1 p.d. Annot. P: *l.c.* pl.49

235 *Simia satyrus* [*Pongo pygmaeus*] **a** skel. of adult ♂ l. lat. Annot. **b** skel. of adult ♂, frontal: Annot. **c** *Pan troglodytes* skel. of adult, frontal: Annot. 3 p.d. R.O. del. P: *l.c.* pl.49,50

236 *Troglodytes niger* [*Pan troglodytes*] **a** ♂ standing, frontal **b** head of ♂ r. lat.: 2 crayon d. J. Zeitter del.

237 *Simia satyrus* [*Pongo pygmaeus*] **a,b** sk. l. lat. to show development: 2 p. & i.d. R.O. del. Annot.

238 **a** [*Gorilla*] cranium, frontal: 1 p.d. **b** [*Pongo pygmaeus*] sk. of ♂ r. lat. & frontal of incisors & canines: 2 w.d. Annot.

239 *Simia syndactyla* [*Symphalangus syndactylus*] sk. & m. **a** frontal **b** l. lat. **c** sk. only, pal.: 3 pen & i.d. T. Rymer Jones del.

240 *Simia satyrus* [*Pongo pygmaeus*] **a** sk. of adult ♂, pal.: 1 p.d. Annot. **b** sk. & lower jaw, 1. lat.: separate teeth: 1 pen, i. & wash d. T. R. Jones del. **c** sk. & lower jaw, frontal: 1 p.d. Annot. **d** sk. of adult ♂, dors.: 1 p.d. Annot.

241 *Simia satyrus* [*Pongo pygmaeus*] sk. **a** post. Annot. **b** ♂ pal. Annot. **c** sk. & lower jaw, l. lat. Annot. 3 w.d. R.O. del.

242 Sk. & m. **a top** [*Pongo pygmaeus*] l. latero-frontal: **a lower** [*Pan troglodytes*] immature, l. lat. **b** *Simia* [*Pan*] *troglodytes* l. lat.: R.O. del. P: *l.c.* pl.55 **c** *Simia* [*Pan*] *troglodytes* ♀ r. latero-frontal: G.S. del. **a–c** 4 w.d.

243 *Simia* [*Pan*] *troglodytes* **a** sk. adult ♀ l. lat. & 7 teeth of young **b** sk. adult pal. & outlines of 7 teeth: 4 p. & w.d. R.O. del. P: *l.c.* pl.51,52

244 *Simia satyrus* [*Pongo pygmaeus*] sk. adult **a** fronto-lat. **b** l. lat.: 2 w.d. G.S. del. P: *l.c.* pl.53

245 [Subfamily Colobinae] **a** sk. l. lat. & tooth rows: 9 p. & w.d. W. Taylor del. **b** ? *Cercocebus* sk. immature l. lat. & pal.: 4 i. & w.d.

246 **a** *Gorilla* sk. immature, frontal & pal.: 2 p.d. E. Deslongchamps del. Annot. **b** [*Pongo pygmaeus*] sk. immature, frontal: 1 p.d. R.O. del. P: *l.c.* pl.56 f.3 **c** *Simia satyrus* [*Pongo pygmaeus*] adult ♀ sk. frontal: 1 p.d. R.O. del. P: *l.c.* pl.56 f.4 **d** *Pongo pygmaeus* sk. l. lat.: 1 p.d. R.O. del. Annot. **e** *Pongo pygmaeus* sk. l. lat.: 1 p.d. R.O. del. Annot.

247 *Simia satyrus* [*Pongo pygmaeus*] **a–c** sk. adult, post.: 3 p.d. **b** Annot. **d** m. of adult, occ. of l. half: 1 p.d. **e** sk. young, post.: 2 p.d. **f** sk. young, occ. of milk & permanent dentitions in alveoli: 2 p. & w.d. **g** individual teeth of young & adult: 17 p. & w.d. **a–g** All R.O. del. **a,e** P: *l.c.* pl.56 f.8,7

248 *Simia* [*Pan*] *troglodytes* sk. young **a** frontal **b** post. **c** pal. **d,e** sk. adult **d** frontal **e** post.: 5 p.d. R.O. del. **a,b,d,e** P: *l.c.* pl.56 f.1,5,2,6

249 *Simia satyrus* [*Pongo pygmaeus*] **a** brain, dors. & vent.: 2 pen & wash d. R.O. del. **b** [Unident. probably primate] 2 brains, vent. & dors. of each: 4 pen & wash d. W.C. del. **c** *Simia* [*Pan*] *troglodytes* brain, dors. & vent.: 2 pen & wash d. R.O. del. Annot.

250 **a,b** *Troglodytes* [*Gorilla*] *gorilla* ♂ lying & sitting, lat. & post.: 4 crayon sketches **a** P: *l.c.* **5** 1865 pl.46 f.1,2

251 **a,b** *Troglodytes* [*Gorilla*] *gorilla* limbs of live specimen: 16 crayon sketches P: *Trans. zool. Soc. Lond.* **5** 1865 pl.46 f.3–6

252 *Troglodytes* [*Gorilla*] *gorilla* **a,c,f,h** sk., frontal, lat. occ. **d,e** head, r. lat., frontal **b,i** hands and feet, dors., vent. **g** young specimen, lying: 9 photos, parts P: *l.c.* pl.47 f.1–7

253 **a** *Pan troglodytes* pelvis, dors. **b** [*Homo*], *Simia satyrus* [*Pongo pygmaeus*], *Ateles*, *Hyaena vulgaris* [*hyaena*], *Mongusta tetradactyla* [*Bradypus* [*Choloepus*] *didactylus*] l. manus skel., dors.: 6 p.d. R.O. del. P: Owen, R. *Anat. Vertebr.* Lond. **2** 1866, p.306 f.191

254 *Simia satyrus* [*Pongo pygmaeus*] **a,b** head musculature, r. lat.: 2 w.d. W. Martin del. **c** sternum & pelvis: 2 w.d. R.O. del. Annot.

255 [? Hominoidea] **a,b** forearm diss. muscles, tendons: R.O.del. **c** ? l. manus: W. Martin del. 3 w.d.

256 [*Daubentonia madagascariensis*] **a** Whole ♂, frontal **b** heads and hand, l. lat. **c** whole animal, dorso-lat.: 3 w.d. J. Wolf del. P: *Trans. zool. Soc. Lond.* **5** 1863 pl.16–18

257 *Daubentonia madagascariensis* ♂ skel. r. lat.: 1 p. & w.d. J. Wolf del. P: *l.c.* pl.19.

258 *Daubentonia madagascariensis* **a** living specimen: 2 i. & wash sketches R.O. del. **b** bones of manus: 1 i. sketch **c** r. manus & pes, palmar: 3 crayon d. **d** head, manus & pes: 10 p. & crayon d. J. Wolf del. P: head only *l.c.* pl.22 f.1

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259 *Daubentonia madagascariensis* **a,c** forelimb muscles, diss.: 2 p. & i.d. Annot. **b1** forelimb & neck muscles **b2** brachial artery: 2 w.d. J. Erxleben del. & lith. P: *l.c.* pl.23,22

260 *Daubentonia madagascariensis* **a,b** forelimb muscles, diss.: 2 p. & w.d. J. Erxleben del. P: *l.c.* pl.23 f.1,2

261 *Daubentonia madagascariensis* **a,b** hind limb muscles, urinogenital system & unident. part, diss.: 5 p. & w.d. J. Erxleben del. P: *l.c.* pl.24,25

262 *Daubentonia madagascariensis* **a,b** hind limb muscles, diss.: 2 pen p. & w.d. J. Erxleben del. P: *l.c.* pl.25 f.2,3

263 *Chiromys* [*Daubentonia*] *madagascariensis* **a** brain, vent. lat. & dors. **b** brain, diss.: palatal ridges, tongue & pharynx. diss.: 8 p. & w.d. **c** larynx, trachea & lungs **d** gut 3 w. & i.d. P: *l.c.* pl.24,22,26

264 **a** *Felis* incomplete skel. l. lat.: 1 wash d. R. Pope del. Annot. **b** [*Panthera leo*] hind toe, anat.: 1 p.d. P: Owen, R. *Anat. of Vertebrates* Lond. **3** 1868 : 70 **c** fore toe; anat.: 1 p.d. **d** *Felis* [? *concolor*] sk.: 1 s.d. **e** *Felis concolor* dors. vertebrae, l. lat. & dors.: 3 p. & s.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.45 f.5–7

265 **a** Sea otter [*Enhydra lutris*] pancreas: 1 p. & w.d. A. B. del. Annot. **b** *Felis catus* (kitten) pancreas, stomach, spleen, duodenum: 1 p. sketch **c** [*Panthera leo*] stomach: 1 p.d. ? Perand del. Annot. **d** [*Felis*] stomach, lat.: 1 p. & w.d.

266 † [*Smilodon neogaeus**] **a,c** r. ramus, occ. & lat. **b** sk., dors. **d** mandible, frontal **e** sk. post, mandible, frontal **f** sk. pal.: 7 p. & w.d. G.S. del. [sk. *No. 21000g mandible No. 21000h]

267 Hyaena [*Crocuta crocuta*] sk. r. lat.: 1 p.d. W.C. del.

268 **a** † *Canis ? lupus* carnassial tooth 3 w.d. Annot. **b** [*Canis familiaris*] sk. l. lat.: 3 p.d. Annot. **c upper** † *Hyaenodon leptorhynchus* [*cf. minor*]* r. ramus, r. lat.: 1 p. sketch P: *Ann. Sci. nat. Zool.* (2) **11** 1839 pl.2 f.1. *No. 29752 **c lower** † *Hyaenodon ? brachyrhynchus* and *H. pachyrhynchus* l. rami, lat.: 3 p. & i. sketches **d** Annot. **e** † *Entemnodus* [*Hyaenodon*] *euryrhynchus* [*cf. minor*]* r. ramus, lat.: 2 p. & i. sketches, Hastings del. Annot. *No. 29752 photo. in *Bull. Br. Mus. nat. Hist.* (Geol.) **23** 1973 pl.5 f.1,2] **f** † [*Canis palustris*]* sk. in matrix l. lat., foot & tail vertebrae. HOLOTYPE of *Galecynus oeningensis* Owen 1847. *No. 27402. P: *Trans. geol. Soc. Lond.* **3** 1835 pl.34 [*Canis*] lower r. tooth row, lingual: r. forefoot, dors.: 6 p.d. L. Aldous del.

269 **a** *Halichoerus grypus* and *Phoca vitulina* rami, lingual: 2 p. & wash d. W.C. del. **b** † *Trichecus* [*Odobenus*] *rosmarus** lower jaw, ant., antero-dors. & l. lat.: 3 p.d. T. Wright del. Annot. *No. 46134

270 **a** [*Odobenus rosmarus*] heart: 1 p. sketch **b** *Phoca* (*Leptonyx*) *serridens* [*Hydrurga leptonyx*] 3 dors. vertebrae, oblique: 1 p.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.46 f.8

271 **a** *Ursus* [*Thalarctos*] *maritimus* sitting, l. lat.: engr. P. Mazell Annot. P: Pennant, T. *Hist. Quadrupeds* Lond. 1781 pl.33 f.1 **b** *Ursus* [*Selenarctos*] *thibetanus* epiglottis, 1 p. sketch, R.O. del. **c** † *Ursus arctos* sk. l. lat.: 1 s.d. G.S. del. Annot. P: Owen, R. *Brit. Foss. Mamm. Birds* Lond. 1846 f.24

272 **a,b** *Suricata* stomach & large intestine, diss.: 2 w.d. R.O. del. P: Owen, R. *Anat. Vertebr.* Lond. **3** 1869 p. 444,445 **c** [*Pteropus javanicus*] sk. & teeth, lat. occ. 5 p. & w.d. W. Taylor del. P: Horsfield, T. *Zool. Res. Java* London 1824 p.301 **d** *Viverra rasse* [*Viverricula malaccensis rasse*] l. lat.: 1 p. sketch W. Taylor del. P: *l.c.* p.345 **e** [? *Meles*] spirit specimen: 1 i. sketch, Annot. **f** [*Mydaus meliceps*] sk. l. lat.: teeth, occ.: anal glands & rectum; post. P: f.C,D,E,L. *Eurylaimus javanicus* & *Podargus* [*Batrachostomus javanensis*] feet, ant. toes. P: f.Q&S, **f** 8 p.d. All P: *l.c.* p.297 **g** [*Mangusta javanica* [*Herpestes javanicus*]] sk. l. lat.: teeth, lat. fronto-occ. P: f.N–T [*Pomatorhinus montanus*] bill, lat. dors.: foot, lat. P: f.W–Z **g** 13 p.d. All W. Taylor del. All P: *l.c.* p.303

273 **a** [*Tupaia tana*] head, dors. lat.: feet, lat.: 4 p.d. W. Taylor del. P: *l.c.* p.229 f.A,B,F **c** [*Tupaia glis ferruginea*] head, lat. & dors.: 2 p.d. W. Taylor del. P: *l.c.* p.229 f.C,D **b** Shrew, unident. head, l. lat.: 1 w.d. **d** [? Shrew] feet, dors.: 2 w.d. **e** *Sorex* [*Condylura*] *cristata* ♀ genitalia, external: 5 i. sketches **f** [*Tupaia javanica* & *Simia syndactyla* [*Symphalangus syndactylus*] head & teeth, l. lat. hand of primate, dors.: 6 p.d. W. Taylor del. P: *l.c.* p.299 f.E,P,Q,R **g,h,i** *Centetes* [*Tenrec ecaudatus*] sk. dors. l. lat. & latero-dors.. 3 w.d. **g** H. Scharf del.

274 **a** *Pteropus rostratus* [*Macroglossus minimus*] ♀, vent., wings open (331 f.H) **b** [*Cheiromeles torquatus*] head, l. lat.: (317 f.I) **c** [*Rhinolophus* [*Hipposideros*] *larvatus*] dors. (323 f.H) 3 p.d. **d** heads, frontal & l. lat. views of **1** [*Rhinolophus affinis*] (307 f.A,B) **2** *Rhinolophus minor* [*pusillus*] (307 f.C,D) **3** [*Rhinolophus vulgaris* [*Hipposideros larvatus*]] (307 f.E,F) **4** [*Rhinolophus deformis* [*Hipposideros larvatus*]] (307 f.G,H) **Centre** [*Rhinolophus nobilis* [*Hipposideros diadema*]] (307 f.L) **Top row** 1 & 2 [*Rhinolophus insignis* [*Hipposideros larvatus*]] (307 f.I,K): 11 p.d. **e,f** *Talpa europaea* **e** 1 & 2 cervical vertebrae, lat. vent.: 3 lumbar vertebrae: 6 i.d. R.O. del. P: Owen, R. *Anat. Vertebr.* Lond. **2** 1866 : 386 **f** 2 young: 1 w.d. Capt Chapman del. Annot.

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g *Nyctinomus tenuis* [*Tadarida* (*Chaerephon*) *plicata tenuis*] (303 f.A–H) sk., lat. dors.: teeth, frontal, lat., occ. & tongue, lat.: 8 p.d. Excepting **e** & **f** all W. Taylor del. P: Horsfield, T. *Zool. Res. Java* Lond. 1821–24, pp. & f. shown in brackets

275 **a** † *Strongyloceros* [*Cervus*] base of shed antler, lat. **b** *Bos* [or *Bison*] 3rd lower molar, lat. & oblique: Annot. **c**† *Cervus* [*Rangifer*] *tarandus** humerus, lat.: back of cranium, dors. & post.: tooth, occ. & lat.: P: Owen, R. *Brit. Foss. Mammals* Lond. 1846 f.198. *No. 36746 **d** † *Bos* [or *Bison*] lower molar, lat. & oblique: Annot. **e** † *Megaceros* [*Megaloceros*] 3rd lower molar, oblique **e** † *Elephas* milk molar, 2nd lower, occ.: Annot. **f** † *Cervus* [? *diaromocervus*] l. lower molar occ.: Annot. **a–f** 13 w.d.

276 † *Anthracotherium magnum** upper jaw, pal.: 1 p.d. *No. 28770

277 † *Anthracotherium magnum** upper & lower tooth rows, l. lat.: 1 p.d. *No. 28770

278 *Sus scrofa* sk. l. & r. lat. & dors.: 3 w.d. Annot. P: *l.c.* f.172

279 *Sus scrofa* leg, foot bones & vertebrae, lat. & oblique: 8 w.d. Annot.

280 † *Hyopotamus* [*Bothriodon*] *vectianus** **a1** lower molars 2 & 3, lingual **a3** symphysis of lower rami, no teeth, occ. both *No. 29784 HOLOTYPE of *H. vectianus* **a2** incomplete r. ramus, labial & occ. *No. 29782 **a4,5** [Unident.] teeth, 2 views **a6** † *Hyopotamus* [*Bothriodon*] incisor, post. ant.: Fig.: *Q. Jl geol. Soc. Lond.* **4** 1848 pl.7 f.18,19 **a7** † *Hyopotamus* [*Bothriodon*] *bovinus** 3rd l. upper molar, lat., occ.: Fig. *l.c.* pl.7 f.5&1. HOLOTYPE* No. 29761 **a** 11 i.d. **b** † *Sus* [*Hyotherium*] *palaeochoerus* 3rd l. upper molar, occ.: 1 i. & w.d. W. del. P: *l.c.* **12** 1856: 233 f.10. Annot. **c** † *Sus* [*Microstonyx*] *antiquus* lower jaw, occ.: 1 p.d. H. Schuler del. **d** † *Dichodon cuspidatus** r. ramus fragment with 3 molars, labial, lingual & occ.: 3 w.d. P: *l.c.* **13** 1857 pl.3 f.1–3 *No. M 3679 **e** † Hippopotamus tusk fragments, lat. & oblique: 2 p.d. **f** † Hippopotamus [?Dwarf], cheek teeth, lat. & oblique: 6 p.d. P. Spratti del. Annot. **g** † *Hippopotamus major* part of femur: 1 i. sketch, J. Gunn del. Annot.

281 *Cervus* [*Muntiacus*] *muntjak* **a** frontlet & antlers, dors. **b** living animal, l. lat. **c** head, frontal & lat.: 5 w.d.

282 *Alces* [*alces*] **a,b** antlers, frontal: 3 w.d. S. Parkinson del. **b** Annot.

283 † *Megaceros* [*Megaloceros giganteus*] antlers, **a** lat. **b** frontal: 2 w.d. [S. Parkinson del.] Annot.

284 *Cervus elaphus* **a,c** ♂ heads with antlers: 2 engr. (10 f.) **b** antler formation: 1 i. sketch. R. Hills del. Annot.

285 [*Cervus elaphus*] **a–e** frontlet & antlers: 5 photos. Annot. **f** dead deer with peruque head: 1 photo. Annot.

286 **a** [*Cervus elaphus*] 6 specimens malformed antlers: 6 p.d. E. W. Cooke del. Annot. **b** [*Cervus canadensis*] post. r. lat.: ♀ and ♂ 1 engr. R. Lawrence del. P: *Colonial Journal* No. 1, 1816 **c** [*Cervus elaphus*] 6 pairs antlers: 1 photo.

287 **a** [*Muntiacus muntjak*] sk., l. lat.: 1 p.d. W.C. del. Annot. **b** [Cervidae] hyoid bones of stag: 1 c.d. **c** *Moschus moschiferus* vertebrae, dorsal 6–14 & 1st lumbar: 1 p.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.48 f.14 *Muntiacus muntjak* **d** sk., l. lat.: **e** head, dors.: 2 p.d. W. Taylor del.

288 **a** † *Strongyloceros spelous* [*spelaeus*] [*Cervus elaphus*] antler, dors. part & scapula fragment: 2 p. sketches. Annot. **b** † *Cervus pedicellatus* 3 antler fragments: 3 p. sketches. Annot.

289 **a** † *Cervus* antler fragment: 1 i. sketch. Annot. **b** [Unident.] antler, broken: 1 i. sketch. Annot. **c** † *Cervus strongyloceros* [*C. elaphus*] antler fragment: 1 i.d. Annot. [a&c J. Gunn del.]

290 † *Cervus sedgwickii* [*Euctenoceros sedgwicki*] antler in 3 parts, l. lat.: 1. s.d. Annot. HOLOTYPE No. 99 Gunn Coll. Norwich Mus.

291 † [*Eucladoceros dicranios*] sk. & antlers, oblique: 1 i. sketch. Annot.

292 *Camelus bactrianus* l. lat.: 1 wash d.

293 **a** *Lama* l. lat.: 1 p.d. **b** *Camelus* head, fronto-lat. & l. lat.: 2 wash d. **c** *Camelus bactrianus* l. lat.: 1 p. & wash d.

294 *Lama* stomach, 1 wash d. Annot.

295 *Lama* stomach, l. lat.: 1 wash d. W.C. del Annot.

296 **a,b** *Bos taurus* [*Bos* domestic] head, frontal & lat.: 2 photos. Annot.

297 **a,b** † *Bison* part of sk. & r. horn core, frontal & post.: Annot. **c** † *Bison* part of sk.: Annot. 3 w.d. W.C. del.

298 † *Bison* **a,b,c** sk., vent. l. lat. & dors.: 3 p.d. H. v. Meyer del.

299 **a** † *Bison trochocerus* [*Bos primigenius*] sk., l. lat. of back **b** † *Bison* [*Bison*] sk. frontal: 2 p.d. H. v. Meyer del.

300 † *Bos trochocerus* [*Bos primigenius*] sk. **a** frontals & horn cores, ant. **b** post. view **a,b** 2 p.d. H. v. Meyer del. P: *Nova Acta physico-med.* **17** 1835 pl.12 f.12,13

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301 † *Bubalus* [*Ovibos*] *moschatus* back of cranium, post. & dors.: 2 w.d. Annot.

302 † *Bubalus* [*Ovibos*] *moschatus* **a,b** imperfect cranium, dors. post.: 2 w.d. G.S. del. Annot.

303 † *Ovibos moschatus* **a** frontlet & horn cores of ♀, dors. & vent. **b** same, ant.: 4 wash & p.d. G.S. del.

304 **a** [*Ovis ammon ? gmelini*] specimen lying, ? lat. view of head: 1 w. & p.d. J. Zeitter del. **b** [*Ovibos moschatus*]* standing specimen, l. lat.: 1 p.d. W.C. del. Annot. *No. 612 a **c** [*Ovis ammon ? gmelini*] head, l. lat.: 1 w.d. ? J. Zeitter del. **d** [*Ovibos moschatus*] sk. & r. lat. & frontal: 2 p.d. Annot.

305 **a** [*Bos* domestic] head, dors.: 1 w.d. R. Hills del. **b** [Bovidae, unident.] young specimen, l. lat.: 1 p.d. **c** [*Bos indicus*] young specimen, l. lat.: 1 p.d.

306 **a** *Antilope bubalus* [*Alcelaphus buselaphus buselaphus*] standing specimen, latero-frontal: 1 w.d. [R. Hills del.] Annot. **b** *Antilope dama* [*Gazella dama mhorr*] standing specimen, l. lat. & rear: 1 w.d. [R. Hills del.] Annot. ? P: *Trans. zool. Soc. Lond.* **1** 1835 pl.1 **c** *Antilope furcifer* [*Antilocapra americana*] standing specimen, r. lat.; head, front: 2 i. & w.d. C. H. Smith del. Annot. *Antilope* [*Kobus ellipsiprymnus*] **d** ♀ 1 w.d. & 1 p. sketch **e** head, detail l. lat.: 2 w.d. **d–e** Both [R. Hills del.] Both Annot.

307 **a** [*Connochaetes gnou*] dead specimen, l. lat.: 1 p.d. Annot. **b** [*Oryx leucoryx*] standing specimen, l. lat.: 1 c.d. [? Smit del.]

308 **a** *Tetraceros* [*Tetracerus quadricornis*] sk. l. lat.: 1 p.d. W.C. del. **b** † [? *Ovis*] skel. remains & teeth: 1 p.d. A. Sedgwick del. Annot. **c** [*Antilocapra americana*] head, l. lat.: 1 s.d. Annot.

309 *Giraffa* articulated skel. l. lat.: 1 pen & i.d. Annot.

310 *Giraffa* **a** skel. articulated, l. lat.: 1 i. & wash d. J. Ibbetson del. Annot. **b** sk. l. lat.: 1 outline i. sketch **c** sk. sagittal section, r. lat.: 1 p.d. G.S. del. Annot. P: *Trans. zool. Soc. Lond.* **2** 1839 pl.40.

311 *Giraffa* **a** leg bones & scapula, lat. **b** thoracic & pelvic skel.: 7 w.d. [J. Ibbetson del.] Annot.

312 **a,b** *Giraffa* head, neck & thorax, diss. to show muscles & vertebrae: 2 p. sketches

313 *Giraffa* **a** head, fronto-lat.: 1 wash sketch. Annot. **b** head & body, standing ♀: 2 w.d. R. Hills del. Annot.: P: *l.c.* **3** 1842 pl.1 **c** dead giraffe: 1 engr. W. Oldham lith.: giraffe tower, Zool. Soc. of Ireland, Dublin and medal designed by Woodhouse: 3 engr. P: *The Amateur* [? 1845–1847] pp.21–22 **d** giraffe six hours old, r. lat. & head: 6 p. sketches & 2 w.d. [R. Hills del.] Annot. P: *Trans. zool. Soc. Lond.* **3** 1849 pl.1. **c** based on a study by F. W. Burton

314 [*Giraffa*] sk. horizontal section showing brain diss.: 1 i. & w.d.

315 'Bunyip' [Ruminant, unident.] **a** sk. pal. Annot. **b** sk. damaged, dors.: Annot. **c** sk. damaged, l. lat.: 1 crayon d. Annot. **a–c** Blockmakers pulls of 3 crayon d. **d** head, l. lat.: 1 i. outline d. R.S.M. del. Annot.

316 **a** [*Equus*] musculature, l. lat.: 1 crayon d. **b** letter relating to **a** dated 9/4/1791 signed W. Hedges **c** † *Equus spelous* [*spelaeus*] astragalus: 1 p.d. R.O. del. Annot. **d** [*Equus*] penis musculature, diss.: 1 p. & wash d. Annot.

317 **a,b** [*Equus asinus*] l. lat.: **a** standing, 1 p. & wash d. **b** lying, 1 p.d.

318 **a** [*Equus*] living specimen with striped markings, l. lat.: 1 w.d. Annot. **b** [*Equus* × *E. zebra* or *E. quagga*] standing specimen, l. lat.: 1 w.d. **c** † [*Equus quagga*] standing specimen, r. lat.: 1 hand c. lithograph G. Edwards del. Annot. P: Edwards, G. *Gleanings of Natural History* Lond. 1758 **5** pl.223 **d** [*Equus*] head, l. lat.: 1 w.d.

319 † *Equus spelaeus* [*Equus caballus*]* **a** forepart of l. ramus & teeth of ♂: occ. P: *Phil. Trans. R. Soc.* **159** 1869 pl.57 f.8, *No. 38187 **b** forepart of m. showing erupting teeth **P**: *l.c.* pl.57 f.7. *No. 38175 b **c** fragment of l. maxilla with premolars in alveolae & deciduous molars, lat.: P: *l.c.* pl.60 f.5. *No. 38175 **d** *Equus spelaeus* var. B [*Equus caballus*] lower molar row, occ.: P: *l.c.* pl.57 f.5. *No. 38175b 4 s.d. [? J. Erxleben del.] Annot.

320 **a** *Equus caballus** teeth of ♂, l. lower & r. upper, occ. P: *l.c.* pl.57 f.1–4 *No. 704b **b** *Equus asinus** teeth of ♂, l. lower & r. upper, occ. P: *l.c.* pl.58 f.1,2 *No. 740e = 58.6.9.18 **c** *Equus hemionus** teeth of ♂ in upper & lower jaws, occ. P: *l.c.* pl.58 f.3,4 Annot. *No. 976 h = 58.6.24.119 **lowest** † Paloplothere [*Palaeotherium*] l. ramus of lower jaw & molar row: 1 lithograph. Annot. **a–c** 6 s.d. [? J. Erxleben del.]

321 **a** *Equus quagga** teeth in jaws, occ.: P: *l.c.* pl.59 f.1,2 *No. 64.7.2.3 **b** *Equus burchelli* ♀ jaws with teeth, occ.: P: *l.c.* pl.59 f.3,4 *No. 854a = 46.6.2.77 **c** † *Equus spelaeus* [*Equus caballus*]* lower teeth, occ. Annot. P: *l.c.* pl.57 f.6: 5 s.d. [? J. Erxleben del.]

322 *Equus spelaeus* [*Equus caballus*]* **a** upper molar row, occ. Annot. P: *l.c.* pl.60 f.2. HOLOTYPE of *E. spelaeus* *No. 38168 **b** part of molar row of young, occ. Annot. P: *l.c.* pl.60, f.4. *No. 38171

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d upper r. molar row, occ. Annot. P: *l.c.* pl.60 f.3. *No. 38169 **c** *Equus zebra* r. upper molar row of young ♂, occ. P: *l.c.* pl.60 f.1. *No. 706b. Annot. 4 s.d. [? J. Erxleden del.]

323 **a,b** *Rhinoceros* [*unicornis*] l. lat. 2 engr. black & sepia [J. Parsons del. G. van der Gricht engr.] **a** Annot. P: *Rhinoceros. A natural history of four-footed Animals.* [London] 1739.

324 † [*Dicerorhinus schleiermacheri*]* cranium, r. lat.: 1 crayon & wash d.: P: Kaup, J. J. *Beitr. z. naeheren Kenntniss d. urwelt. Saeugethiere*, Darmstadt 1854–61 Pt 1, pl.10 f.1 Cast *No. M 2781

325 † [*Dicerorhinus schleiermacheri*]* cranium, dors.: 1 crayon & wash d. [? J. J. Kaup del.] P: *l.c.* pl.10 f.1A Cast *No. M2781

326 † [*Aceratherium incisivum*]* crania, **a** incomplete posteriorly **b** incomplete anteriorly both dors.: 2 crayon & wash d. P: Kaup, J. J. *Descr. Ossements foss. de Mammifères*, Darmstadt 1832 pl.10 f.2a & 2b. Cast *No. M 2788

327 **a** † *Rhinoceros* [*Dicerorhinus*] *schleiermacheri** **top** tooth row, occ. P: *l.c.* pl.11 f.5 Cast *No. M 2781 **centre** femur [? humerus], frontal. P: *l.c.* pl.13 f.5. Cast *No. 1283 **lower** r. upper milk molars: P: *l.c.* pl.11 f.7. Cast *No. [110b (O. C.)] 3 p. & i.d. J. J. Kaup del. **b** † [? *Dicerorhinus schleiermacheri*] upper premolar, latero-occ.: 1 i.d. Laurrillard del. **c** † *Aceratherium** l. maxilla with teeth, l. labial: 1 i. & wash d. J. J. Kaup del. Cast *No. M 2744 **d** † *Aceratherium incisivum* post. part of cranium, l. lat.: 1 i.d. [? J. J. Kaup del.]

328 *Rhinoceros indicus* [*unicornis*] **a** penis: **a1** diss. **a2** lat. **a3,4** views of end: 4 p. & w.d. P: (except **a2**) *Trans. zool. Soc. Lond.* **4** 1862 pl.17 f.2–4 **b** prepuce & penis: 5 c.d. 3 P: *l.c.* pl.9 f.4–6. Annot.

329 *Rhinoceros indicus* [*unicornis*] brains **a1–4** ♀ diss.: P: *l.c.* pl.22 f.1–4 **b** ♂, vent. diss.: P: *l.c.* pl.20 **c** ♂, dors. diss.: P: *l.c.* pl.21 **d** ♂, dors. & lat.: P: *l.c.* pl.19 f.1,2. Annot. 8 p. & w.d. [J. Erxleben del.]

330 *Rhinoceros indicus* [*unicornis*] **a** jejunum: beginning, inner surface **b** ileum: end, inner surface **c** jejunum: end, inner surface. P: *l.c.* pl.12 f.1–3 **d** larynx diss. P: *l.c.* pl.15 f.2 **e** caecum, colon & beginning of rectum P: *l.c.* pl.13 **f** stomach, part of inner surface: P: *l.c.* pl.14 **g** tonsil, epiglottis & part of larynx. P: *l.c.* pl.10 f.1 **h** larynx, vent.: P: *l.c.* pl.15 f.1; 8 p. & w.d. [J. Erxleben del.]

331 *Rhinoceros indicus* [*unicornis*] **a** metacarpal & metatarsal glands: 3 p. sketches: P: *l.c.* pl.9 f.1–3 **b** incisors erupting, occ.: 4 p.d. **c** [? *Dicerorhinus sumatrensis*] mounted skel. l. lat.: 1 p. & i.d. **d** Rhinoceros [? *Ceratotherium simum*] sk., spine & ribs, l. lat.: 1 w. sketch R. Pope del. Annot. **e** Rhinoceros pelvic & pectoral girdles, r. lat.: 3 i. sketches R.O. del. Annot.

332 **a** † Rhinoceros **a left** atlas vertebra, dors.: 1 w.d. **a right** mandibular ramus with 3 teeth, ant. end, lat.: 1 p.d. Kaup del. **b** † *Rhinoceros tichorhinus* [*Coelodonta antiquitatis*] astragulus, dors.: 3 cheek teeth, occ.: ? scapula & humerus, lat.: **verso** atlas vertebra, vent. & ant.: l. mandibular ramus with 5 teeth, occ. & lat.: 9 p.d. Annot. **c** Rhinoceros [? fossil] lower molar, 3 views: 3 w.d. Annot. **d** † *Rhinoceros tichorhinus* [*Coelodonta antiquitatis*] cranium, r. lat.: 1 i.d. J. Hakewill del. Annot. **e** Rhinoceros [? fossil] tooth, occ.: 1 w. & i.d. **f** *Rhinoceros* upper & lower tooth rows, occ.: 2 crayon sketches **g** † *Rhinoceros tichorhinus* [*Coelodonta antiquitatis*] l. ramus showing teeth including unerupted molar, l. lat.: 1 p.d. Annot.

333 *Tapirus* [*indicus*] **a** r. lat.: 1 outline p.d. Annot. **b** r. lat.: 1 c.d. Annot.

334 **a** *Elephas africanus* [*Loxodonta africana*] nasals, tusks & molars, dors. & occ. *Elephas asiaticus* [*maximus*] molar, occ. **b** *Elephas africanus* [*Loxodonta africana*] sk. of young animal, l. lat. **c** cranium & lower jaw, occ. [probably same specimen as **b**] **d,e** *Elephas asiaticus* [*maximus*] sk. l. lat.: Annot. **a–e** 5 photos

335 **a** † *Elephas* [*Mammuthus*] *primigenius* [? *Loxodonta africana*] skel. of young specimen, l. lat.: **b** [*Elephas maximus*] skel. r. lat.: both i. & wash d. Annot.

336 **a** † [*Mammuthus primigenius*] skel. r. lat.: 1 engr. G.S. lith. Annot. P: Owen, R. *Hist. Brit. foss. mammals & birds*, Lond. 1846 f.85 **b** † *Mastodon giganteum* [? *Mammut americanum*] skel. r. lat.: 1 w. & i.d.

337 **a,d,e,f** † [Owles collection of bones & teeth dredged off Dogger Bank. 4 photos, each of which shows a variety of specimens, some of which have been identified]: **a** centre † [*Mammuthus primigenius*]* r. femur *No. 46270 **b** † [*Anancus arvernensis*]* molar, lat.: Annot. Cast *No. M 2902 **c** † *Elephas* [*Mammuthus*] *primigenius* skel. r. lat. & frontal: Annot. **d** † [*Mammuthus primigenius*]* lower m., frontal. *No. 46197 † Rhinoceros, unident. cranium, l. lat. † [Elephants, unident.] tusks, molars & bones **e** † [*Odobenus rosmarus*]* lower m., occ. *No. 46134 † [*Mammuthus primigenius*] tusks, teeth & bones **f** † [Castoridae, unident.] sk., r. lat.: † [*Megalo-*

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ceros giganteus]* cranium of ♀, l. ventro-lat. *No. 46106 † [*Megaloceros*]* frontlet & pedicles *No. 46107 † [*Mammuthus primigenius*]* innominate *No. 46268 **a–f** 7 photos

338 **a** † [? Hippopotamus] molar, lat. **b–d** † [Elephantidae] **b** molar, occ. **c** molar, latero-occ. **d** molar, occ.: Annot. **a–d** 4 p.d. **e** Mammoth, part of tusk, post. & lat.: 1 i. & wash d. Annot.

339 **a–c** † [*Mammuthus* cf. *primigenius*] lower molar, lat. & latero-occ.: 3 w.d. C.S. del. [? C. Stubbs]. Annot.

340 † [*Elephas* [*Mammuthus*] *primigenius*] **a** molar, occ.: 1 c.d. Annot. **b** † [*Mammut americanum*] molar, occ.: 1 c.d. Annot.

341 † [*Elephas* [*Mammuthus*] *primigenius*] **a** molar, occ.: 1 c.d. Annot. **b** † [Elephantidae] molar, occ.: 1 c.d. Annot.

342 **a** † *Elephas* jaw with tooth & bone fragments: 5 i.d. Annot. **b** † Mammoth head of humerus: 1 wash d. Annot. **c** † [Elephantidae] tusk, lat.: i.d. [J. Gunn del.] Annot.

343 **a** † [? *Mammut americanum*] sk. l. lat.: Annot. **b** † [Elephantidae] sk. fronto-lat.: Both i. outline d.

344 † [*Mammut americanum*]* incomplete mounted skel. l. lat.: 1 i. & wash d. G.S. del. Annot. *No. 15913

345 † [*Mammut americanum*]* **a** incomplete m. & teeth, l. lat. & frontal: 4 w. & outline d. G.S. del. **b** incomplete cranium with tusk, dors.: 1 w.d. **c** l. fore & hind feet skels, frontal: 4 c.d. G.S. del. All. *No. 17144

346 † [*Mastodon americanus* [*Mammut americanum*]] **a** upper M2 **b** upper M3, occ. & lat.: 4 w.d. G.S. del.

347 † [*Mastodon americanus* [*Mammut americanum*]] **a** upper M2, occ. & lat. **b1** r. lower 2nd milk tooth, occ. & lat. *No. 17562 **b2** r. upper 2nd milk tooth: occ. & lat. *No. 17565 **b3** r. lower M3, occ. & lat. *No. 17563 **b4** r. lower milk molar, occ. & lat. *No. 17564. 10 w.d. G.S. del. **c** † [*Mammuthus* cf. *meridionalis*] r. lower molar, occ.: 1 w.d. G.S. del. Annot.

348 † [*Mammuthus*] **a** r. ulna & radius, 2 w.d. G.S. del. **b** r. humerus: 2 w.d. G.S. del. **c** r. tibia & fibula: 2 w.d. [G.S. del.] Annot.

349 **a** [Proboscidea, unident.] incomplete bone, 1 c.d. Annot. **b** † [*Mammuthus*] l. femur, 3 lat.: 3 w.d. G.S. del. Annot.

350 † *Mammutus* [? *Mammut americanum*] **a,b** mounted skel. post. & lat.: **a** 1 p.d. **b** 2 i.d. Annot.

351 **a** † *Elephas* 2nd upper molar, oblique: 1 s.d. Annot. † *Mastodon* [*Tetralophodon*] *longirostris** **b** r. ramus, milk dentition: 1 p.d. Annot. **c,d** r. ramus, milk dentition: 2 p. & w.d. **d** E. Markwrost del. Annot. **b–d** All Cast *No. 36756 P: Kaup, J. J. *Beitr. z. näheren Kenntniss d. urwelt. Säugethiere* Darmstadt, 1854–61 Pt 3 pl.2 f.2 [as *M. arvernensis*]

352 † *Mastodon* [*Stegolophodon*] *latidens** **a** lower milk tooth, 3 views: 3 c.d. W.C. del. Annot. **b,c** r. upper molar, oblique & occ.: 2 w.d. P: Falconer, H. & Cautley, P. J. *Fauna Antiqua Sivalensis* . . . Lond. 1846–49 pl.31 f.2,2a *No. M 10518 **d** † *Mastodon* [*Stegodon*] *elephantoides** upper molar, oblique: 1 w.d. [W.C. del.] Annot. P: Clift, W. *Trans. geol. Soc. Lond.* **2** 1828 pl.39 f.6 SYNTYPE *No. M 10520. Cast *No. 7388

353 **a** † [*Mammuthus*] tooth, frontal: 1 wash d. Annot. **b** † Mammoth [*Mammut americanum*]* r. ramus, lingual: 1 wash d. Annot. P: Hunter, J. *Phil. Trans. R. Soc.* **58** 1768 pl.4 f.1,3 *No. [3 (O. C.)] **c** † [*Mammuthus*] tooth, lat.: 1 wash d. **d** † *Mastodon* [*Stegolophodon*] *latidens** r. upper M2 & M3 in part of palate: 1 w.d. [W.C. del.] P: *Trans. geol. Soc. Lond.* **2** 1828 pl.37 f.1. HOLOTYPE *No. M 29713. Cast *No. M 2888. Annot.

354 † [*Mammut americanum*]* incomplete cranium & 3rd molar **a** pal. **b** post. **c** l. lat. **d** dors.: 4 w.d. G.S. del. *No. 345

355 † *Mastodon* [*Stegolophodon*] *latidens** palate & ? 3rd molar each side: 1 w.d. W.C. del. P: *l.c.* pl.36, *No. M 10514

356 † *Mastodon* 3 long bones, lat. & distal: 4 wash & 1 i. outline d. Annot.

357 † *Mastodon* **a** 2 phalanges, dors. & vent. **b** bone fragment: 5 wash & i.d.

358 **a** † *Dinotherium* [*Deinotherium giganteum*] l. upper molar, occ.: 1 w.d. W.C. del. Annot. **b,c,d** † [*Mastodon* [*Tetralophodon*] *longirostris*]* axis vertebra, 1. lat., post & ant.: 3 w.d. [? J. J. Kaup del.] P: Kaup, J. J. *Descr. ossements foss. de Mammifères*, Darmstadt 1835 pl.22 f.2–2 b *No. M 3408 **e** † [*Tetralophodon longirostris*]* germ of 1st upper molar, oblique: 1 p.d. [? J. J. Kaup del.] P: *l.c.* pl.21 f.7. *No. M 2916 **f** † [*Tetralophodon longirostris*]* part of maxilla & tooth row, l. lat.: 1 i.d. P: *l.c.* pl.19 f.1. Cast *No. M 2907

359 **a** † *Mastodon* [*Tetralophodon*] *longirostris** **a1** last upper molar, lat.: *No. 2923 **a2** 3rd lower molar, lat.: *No. M 2899 **a3** upper premolar 4, occ.: Annot. *No. 2914 **a4** ? 4th premolar, occ. **a5** ? molar, lat. **a6** premolar, oblique: 6 p. & wash d. ? Kaup del. **b** † [*Dinotherium* [*Deino-*

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therium giganteum]] **b1** upper molars, occ.: P: *l.c.* pl.2 f.2 **b2,3** upper molars, oblique. **b4** upper molar, lat. P: *l.c.* pl.2 f.10 **b5** l. lower molar, oblique: *No. 1735 i **b6** upper molars lettered (a–d) P: *l.c.* pl.2 f.6,3,5,4. *Nos 1272, 1735 e, 1735 d **b7** molar crown, oblique. **b8** lower molar row in part of ramus, lat. P: *l.c.* pl.5 f.1 **b9** lower molar, lat. P: *l.c.* pl.5 f.2 **b10** [Proboscidea, unident.] molar, lat. Annot. 13 p. & w.d. All J. J. Kaup del. All * specimens are casts

360 **a** † *Dinotherium gig.* [*Deinotherium giganteum*] teeth **a1–3** [? molars] crowns, oblique **a4** upper molar crown, oblique P: *l.c.* pl.2 f.7 **4 bis centre** tooth, lat. **a5** † *Mastodon* [*Tetralophodon*] *longirostris* cheek tooth, oblique. **a6–8** † [*Dinotherium gigantei* [*Deinotherium giganteum*]] **a6** incomplete tusk, lat. P: *l.c.* pl.3 f.1 a **a7,8** tusks, end view. P: *l.c.* pl.3 f.1 b & 1 c **a** Annot. 9 crayon & wash d. **b,c** † [*Dinotherii gigantii* [*Deinotherium giganteum*]] incomplete l. ramus & symphysis, lat., post. & occ.: 3 p. & c.d. Annot. P: *l.c.* pl.4. Casts *Nos 1275, 1542

361 **a** Rhinoceros [unident.] ant. part of cranium, l. lat. **b,c** † [*Deinotherium giganteum*] l. ramus & symphysis, occ. lat.: 3 crayon & wash d. [? Kaup del.]

362 † [*Dinotherium* [*Deinotherium*] *giganteum*]* **a** incomplete ant. part of palate with teeth, occ.: 1 p.i. & w.d. *No. 1270 *b* same as **a** 1 p.d. *No. 1271. Both casts. J. J. Kaup del. P: *l.c.* **a** pl.1 bis f.2 **b** pl.1

363 **a** † *Merycopotamus* [? *Hippohyus*] upper molar 1 & premolar 4, occ.: 2 p.d. **b** † *Elasmotherium* incomplete scapula, dors.: 1 w. & i.d. J. J. Kaup del. Annot. **c** † *Hyracolestes* [*Pliolophus vulpiceps* [*Hyracotherium leporinum*]]* l. ramus with P3–M3 **c8,8a** occ. **c7** lingual, **unnumbered** labial: 4 s.d. P: *Q. Jl geol. Soc. Lond.* **14** 1858 pl.3 f.5,6,4. HOLOTYPE of *P. vulpiceps* *No. 44115 **d** † *Lophiodon issellensis* [*isselensis*]* 2nd phalangeal of 3rd digit of r. forefoot, ant. post. & l. lat.: 3 w.d. Caroline Owen del. Annot. **d1** P: Owen, R. *Hist. Brit. foss. mamm. & birds*, Lond. 1846 f.106: *No. 29743 **e left** † *Hippohyus* [*sivalensis*]* upper teeth, occ. *No. M 2053 **e** right † *Merycopotamus* [*dissimilis*]* upper teeth, occ. *No. 16551: 2 p.d. P: Falconer, H. & Cautley, P. J. *Fauna Antiqua Sivalensis* . . . Lond. 1846–49 pl.70 f.1 & pl.76 f.3.

364 † *Pliolophus vulpiceps* [*Hyracotherium leporinum*]* **a** l. maxilla **5** occ. **5a** occ. **5b** l. lat. **6** M1 & M2 occ.: 4 s.d. P: *Q. Jl geol. Soc. Lond.* **14** 1858 pl.3 f.1–3 **b top** † *Hyracotherium leporinum** cranium, dors.: woodcut. P: *Trans. geol. Soc. Lond.* **6** 1841 f.2. *No. M 16336 **b lower** sk. before development **b2** l. lat. **b3** dors. **b4** vent. **c** sk. r. lat. **b,c** 4 w.d. P: *l.c.* pl.2. HOLOTYPE *No. 44115

365 † *Toxodon* [*platensis*]* m. **a** r. lat. & ant. **b** r. tooth row, occ. **c** occ. 4 s.d. J. Dinkel del. *No. 19949

366 † *Toxodon platensis** **a** incomplete cranium, dors. **b** cranium, post.: 2 p.d. G.S. del. P: Owen, R. *Zool. voyage Beagle* Lond. 1838 Pt 1 **a** pl.3 **b** pl.4. HOLOTYPE *No. M 16560

367 † *Toxodon* [*platensis*]* **a** cranium, vent. molar, 4 views **b** incomplete cranium, r. lat.: 6 p.d. G.S. del. P: *l.c.* **a** pl.4 **b** pl.2. HOLOTYPE *No. M 16560

368 † *Toxodon* [*platensis*]* incomplete cranium, r. lat.: 1 prelim. p.d. G.S. del. HOLOTYPE *No. M 16560

369 † *Toxodon* [*platensis*]* sk. ant. **a** dors. **b** r. lat. **c** l. lat. 3 s.d. J. Dinkel del. *No. 19948

370 *Hystrix* **a** caecum **b** stomach & spleen **c** [*Sciurus plantani* [*Callosciurus notatus notatus*]] live specimen, l. lat. **d** *Gerbillus burtoni* [*pyramidum pyramidum*] sk. pal. **e** *Dipus hirtipes* [*Jaculus jaculus*] sk. dors. **f** [Dasyproctidae, unident.] ♂ organs **g** *Capromys* ♂ organs **h** [*Mus setifer* [*Bandicota indica setifera*]] living animal, r. lat.: 8 p. sketches **c,h** W. Taylor del. **c,h** P: Horsfield, T. *Zool. Res. in Java* . . . Lond. 1824 **c** p.361 **h** p.357

371 † *Archaeopteryx macrurus* [*lithographica*]* skel. remains in block: 1 p.d. J. Dinkel del. Annot. P: *Phil. Trans. R. Soc.* **153** 1863 pl.1 [HOLOTYPE of *A. macrura* *No. 37001]

372 **a** † *Castor tägeri*, † *Spermophylus* [*Spermophilus*] *superciliosus* individual teeth, sk. & long bones: 34 p.d. Mangold del. Annot. P: *S. superciliosus* in Kaup, J. J. *Descr. Ossements foss. Mamm.* Darmstadt, 1839 pl.25 f.4,3 **b** † *Spermophylus citillus* [*Spermophilus superciliosus*], † *Arctomys primigenia* [*Marmota marmota*] sk. & long bones: 11 p.d. Kaup del. Annot. 2 top left d. P: *l.c.* pl.25 f.5–6 **c** † *Arctomys primigenia* [*Marmota marmota*] sk. lat. & dors., first 10 vertebrae, l. lat.: 11 p.d. Kaup del. Annot. sk. d. P: *l.c.* pl.25 f.1–2

373 **a left** *Mus* [? *Rattus*] **a right** [*Mastacomys fuscus*] both sk. l. lat.: teeth, occ.: 8 p.d. **b** *Oryctolagus* pelvis, r. lat.: l. mandible, lat.: scapula: 3 p. & w.d. Annot. **c** *Hydrochoerus capybara* [*hydrochaeris*] vertebrae 8–14, dors.: 1 s.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.47 f.11 **d** *Castor fiber* & *Macropus major* [*giganteus*] caudal vertebrae, 7th & 9th, dors. vent. & ant.: 6 s.d. P: *l.c.* pl.53 f.61,62 Annot. **e** † *Helamys* [*Platychelys*] *capensis* dors. & lumbar vertebrae, l. lat.: 1 p.d. P: *l.c.* pl. 46 f.9

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374 **a** † *Glyptodon* sk. & mandible, l. lat. **b** † *Glyptodon – Hoplophorus* sk. & mandible, r. lat. Annot. **c** † *Glyptodon – Panochtus* [*Panochthus*] sk. & mandible, r. lat. Annot. **d** † *Toxodon* sk. & mandible, r. lat. Annot. **e** † *Homo* from S. America sk. & mandible, l. lat. Annot. **f** † *Scelidotherium* mounted skel. r. lat. Annot. **g** † Scelidothere, skel. of l. hindfoot, lat. **a–g** 7 photos

375 † Megatherioid [Megatheriid] **a** lower jaw, occ. **c** sk. l. lat. **d** sk. pal. **b,e** † *Megatherium* mounted skel. l. lat.: 5 photos. Annot.

376 † *Megatherium americanum* articulated skel. oblique frontal: [J. Dinkel del.] 1 s.d. P: *Phil. Trans R. Soc.* **148** 1858 pl.18 Cast of composite skel. *No. M 26540

377 † *Megatherium americanum* skel. 1. lat.: 1 i.d. Annot.

378 † *Megatherium* 7th cervical & 1st dors. vertebrae, dors.: 1 s.d. P: *l.c.* **145** 1855 pl.20 f.5

379 † *Megatherium* vertebrae **a** axis **b** 3rd cervical **c** atlas, 4 views **d** 6th cervical, ant. & l. lat. 10 s.d. P: *l.c.* pl.20,21

380 † *Megatherium* **a** 7th cervical vertebra, post. & lat. **b** 7th dors. vertebra, post. lat. ant. 5 s.d. J. Dinkel del. P: *l.c.* pl.19,20

381 † *Megatherium* **a** 16th dors. vertebra, 3 views **b** 13th dors. vertebra, 4 s.d. J. Dinkel del. P: *l.c.* pl.19,26

382 † *Megatherium* 1st & 2nd caudal vertebrae, post. & vent.: 4 s.d. J. Dinkel del. Annot. P: *l.c.* pl.18, 24, 26

383 † *Megatherium* **a–c** caudal vertebrae, 12 views: 12 s.d. J. Dinkel del. P: *l.c.* pl.24

384 † *Megatherium* **a** scapula **b** glenoid cavity & acromio-coracoid arch: 2 s.d. P: *l.c.* pl.19

385 † *Megatherium* haemapophyses of dors. vertebrae or bones of sternum: 3 s.d. J. Dinkel del. P: *l.c.* pl.27

386 † *Megatherium* dors. vertebrae, 9 views: 9 s.d. J. Dinkel del. P: *l.c.* pl.27

387 † *Megatherium americanum** **a** hind foot bones *No. 19953 ? **b** bones of r. fore-foot articulated: **a,b** 2 s.d. Both J. Dinkel del. **b** P: *l.c.* pl.22 *No. 19953

388 ? † *Megatherium* pelvis **a** ant. **b** dors.

389 † *Megatherium* **a** **f.1** pelvis, lat.: 1 s.d. **f.2** acetabulum: 1 p.d. P: *l.c.* **149** 1859 pl.37 **b** pelvis, vent.: 1 s.d.

390 † *Megatherium* **a,b** 15th & 16th ribs: 3 s.d. P: *l.c.* **145** 1855 pl. 26 **c** pelvis, l. lat.: 1 s.d.

391 † *Megatherium* **a** femur, proximal & distal ends **b,c** 2 unident. bones **d** tibia, proximal end, tibio-fibula, distal end: **a–d** 6 s.d. [J. Dinkel del.] **a&d** P: *l.c.* **149** 1859 pl.39 f.1–4

392 † *Megatherium* **a** calcaneum, ant.: 1 s.d. J. Dinkel del. P: *l.c.* pl.41 f.2 **b** navicular bone, astragulus & calcaneum, ant.: 1 s.d. J. Dinkel del. P: *l.c.* pl.40 f.3

393 † *Megatherium* **a** 2 cuneiform & cuboid bones, ant.: 1 s.d. J. Dinkel del. P: *l.c.* pl.40 f.2 **b** † *Megatherium americanum** foot bones, dors.: 1 s.d. P: *l.c.* pl.41 f.1 *No. 19953 **c** foot bones, tibial side: 1 s.d. P: *l.c.* pl.40 f.1

394 † *Megatherium* **a** skel. l. fore-foot: l. lat. **b** skel. l. hind foot, r. lat.: 2 w.d. G.S. del.

395 **1** † *Mylodon robustus* articulated skel. r. lat.: 1 wash d. G.S. del. P: Owen, R. *Descr. skel. extinct gigantic sloth* London 1842 pl.1 **2** *Bradypus tridactylus* skel. l. lat.: 1 p.d.

396 † *Mylodon robustus* sk. l. lat.: 1 p. outline d. P: *l.c.* pl.2

397 † *Scelidotherium leptocephalum** cranium, r. lat.: 1 crayon outline d. P: *Phil. Trans. R. Soc.* **147** 1857 pl.8 f.1 [Reconstruction using posterior portion of *No. 32995]

398 † *Scelidotherium leptocephalum** **a** m. occ. **b** lower molar row, occ.: 2 p.d. P: *l.c.* pl.8 f.5 & pl.9 f.2 *No. 37649 Part of HOLOTYPE of *S. bravardi*

399 † *Scelidotherium leptocephalum** reconstructed sk., pal. & lower molar surfaces; 2 p.d. P: *l.c.* pl.9 f.1,3 *No. 32995

400 † *Scelidotherium leptocephalum** partially restored cranium & m. r. lat.: 3 p.d. P: *l.c.* pl.8 f.2,4 *No. 37626 – cranium. *No. 37649 – m. Parts of HOLOTYPE of *S. bravardi*. Teeth of *No. 37309

401 † [Mammalia unident.] cranium & bones in matrix: 1 s.d. J. Dinkel del. Annot.†

402 † *Glyptodon* [*clavipes*] **a** cranium sagittal section, l. lat. **b** cranium, vent. & dors.: 3 w.d. G.S. del. **b** P: [Owen, R.] *Descr. & illustr. Cat. Fossil . . . Mammalia & Aves . . . Roy. Coll. Surgeons of England* Lond. 1845 pl.3

403 **a,b** † *Glyptodon* [*Doedicurus clavicuadatus*]* caudal sheath, 2 views: 2 s.d. J. Dinkel del. HOLOTYPE of *D. clavicaudatus* *No. 19955

404 **a** † *Mylodon harlani** parts of lower jaw, 3 views: 3 i.d. Annot. Cast of HOLOTYPE *No. 7375 **b&c** † *Glyptodon* [*Panochthus tuberculatus*] parts of tail; 2 photos. Annot. **d** † *Glyptodon clavipes* carapace: 11 p.d. G.S. del. Annot. HOLOTYPE – Roy. Coll. Surg. Cat. No. 541 P: [Owen, R.]

Folio

Descr. & illustr. cat. Fossil . . . Mammalia & Aves . . . Roy. Coll. Surgeons of England. Lond. 1845 pl.1 [Destroyed in 1941]

405 † *Glyptodon** **a** sacro-caudal vertebrae, vent. **b** pelvis, lat.: 2 s.d. J. Dinkel del. both *No. 40067

406 † *Glyptodon* **a** [*Panochthus tuberculatus*]* caudal sheath, *No. 19954 **b** [*Doedicurus clavicaudatus*]* caudal vertebrae, 3 views: *No. 19955 HOLOTYPE 4 s.d. J. Dinkel del.

407 † *Glyptodon* [*Panochthus tuberculatus*]* **a,c** armour fragment, ant. post. (see also Fol. **408 b,c**) **b** vertebra within caudal sheath, proximal end. *No. 19954 3 s.d. [? J. Dinkel del.]

408 † *Megatherium* r. clavicle, vent.: 1 s.d. **P**: *Phil. Trans. R. Soc.* **148** 1858 pl.20 f.1 **b,c** † *Glyptodon* [*Panochthus tuberculatus*] outer & inner surfaces of armour fragment: 3 s.d. J. Dinkel del. (see also Fol. **407 a,b**)

409 † *Glyptodon* [*Panochthus tuberculatus*]* caudal sheaths: 2 s.d. J. Dinkel del. *No. 19954

410 **a,b** *Dasypus* [*Priodontes*] *giganteus* fore & hind feet, vent. & lat.: 2 c.d. W.C. del. Annot.

411 **a** *Dasypus septemcinctus* submaxillary salivary gland & bladder diss. out: 1 p.d. R.O. del. **b** *Chlamyphorus* [*truncatus*] articulated skel. hind & fore-limbs; l. lat.: 2 p.d. **P**: Owen, R. *Anat. Vertebr.* London 1866 **2** f.275,277 **c** *Dasypus* [*Euphractus*] *sexcinctus* submaxillary salivary gland: 1 i. & wash d. R.O. del. **d** *Dasypus peba* [*novemcinctus*] head & submaxillary salivary gland diss. out, vent.: 1 p.d. R.O. del. **c,d P**: *Trans. zool. Soc. Lond.* **4** 1853 pl.40 f.1,2 **e,f** *Dasypus* [*sexcinctus*] intestine & stomach: 2 p.d. R.O. del.

412 **a i,ii** † *Mylodon* **iii,iv** † *Megalonyx* **v,vi** † *Megatherium* **vii,viii** † *Scelidotherium* astragalus of each, proximal & distal: 8 p.d. **b** *Dasypus longicaudus* [*novemcinctus*] dors. & lumbar vertebrae: 1 p.d. **P**: *Phil. Trans. R. Soc.* **141** 1851 pl.49 f.18 **c1** *Bradypus tridactylus* dors. & lumbar vertebrae: 1 i. & p.d. **c2** *Dasypus* [*Tolypeutes*] *tricinctus* dors. & lumbar vertebrae: 1 w.d. **P**: *l.c.* pl.49 f.17,19 **d top** † Scelidothere, ant. part skel. & lat.: 1 p.d. **d1** † Scelidothere **d2** *Orycteropus* **d3** [Dasypodid – unident.] **d4** [*Myrmecophaga tridactyla*] **d1–4** cervical & dorsal vertebrae of each, r. lat.: 1 lithograph (4f.) G.S. lith. **P**: Owen, R. *Zool. Voy. Beagle* Pt 1 Lond 1838 pl.24

413 *Myrmecophaga jubata* [*tridactyla*] **a** 11th, 15th dorsal & 3rd lumbar vertebrae, ant. post.: 6 p.d. [J. Dinkel del. et lith.] **P**: *Phil. Trans. R. Soc.* **141** 1851 pl.50 f.21–23 **b** 1st caudal vertebra, ant.: 1 s.d. [J. Dinkel del. et lith.] **P**: *l.c.* pl.53 f.60 **c** sacral vertebra, ant.: 1 i. & w.d. **d** 11th, 15th & 1st–3rd lumbar vertebrae, l. lat.: 1 p.d. J. Dinkel del. **P**: *l.c.* pl.49 f.20

414 *Myrmecophaga gigantea* [*tridactyla*] muscles of forearm diss.: 1 c.d. H. R. Silvester del. Annot.

415 **a** [*Myrmecophaga tridactyla*] heart, r. auricle diss.: 1 w.d. H. V. Carter del. Annot. **b** *Myrmecophaga* [*Cyclopes*] *didactyla* head, diss. to show salivary gland, l. lat.: 1 p.d. R.O. del. Annot. *Bradypus* [*Choloepus*] *didactylus* **c** skel.: 1 i. & w.d. J. C. Frank del. et lith. Annot. **d** muscles of upper hind limb diss.: 1 p. sketch R.O. del. Annot.

416 *Dugong* l. lat.: 1 c.d. Annot.

417 *Trichechus* **a** head, l. antero-lat.: 1 p. sketch. Annot. **b** whole animal, l. latero-vent.: 2 p. sketches Both R. Hills del. Both Annot. [Described by Sir E. Home in *Phil. Trans. R. Soc.* **111** 1821: 390 pls 26–28]

418 **a** [? *Eotheroides aegyptiacum*] shells, tusk & cervical vertebrae in limestone matrix: 1 p. sketch Annot. **b** [Unident. ? part of same block as above] incomplete tusks in matrix of limestone: 1 p. sketch **c,d** *Dugong* lower & upper jaws, occ.: 2 p.d. Annot. **e** *Halicore indicus* [*Dugong dugon*], *Halichore australis* [*Dugong dugon*] 4 pp. of MS headed 'Comparison of adult male sk . . .'

419 † [*Halitherium*] **a** incisors, 4 views. Annot. **b** molar, lat. occ. **c** incomplete pelvis, 2 views including verso: 8 p.d. **d** incomplete sk. l. lat.: 1 p., i. & w.d. Annot. **e,f** axis vertebra, lat., ant., post.: 3 p. & w.d. **f** Annot. **g** lumbar vertebrae, 5 views **h** lumbar vertebra, ant. & post. **i** thoracic vertebra, ant. & lat.: 9 p.d. **j** † *Halitherium uytterhoeveni* disarticulated skel. dors.: 1 photo by E. Moire. Annot.

420 † *Prorastomus sirenoides** sk. of type specimen before it was developed **a** vent. **b** l. lat. **c** dors.: 7 rough p. & i. sketches, prelim. drawings for *Q. Jl geol. Soc. Lond.* **31** 1875 pl.28 f.3,1,2 HOLOTYPE *No. 44897

421 **a,c** *Monodon monoceros* r. lat. 2 w.d. **b** l. lat. 1 pen & wash sketch, Annot.

422 *Balaena* [*Balaenoptera musculus*] r. lat. of animal & skel.: 1 engr. (4f.) & description with measurements. G.S. del. et lith.

423 *Balaena boops* [*Megaptera novaeangliae*] **a** vent. surface, tail & penis: 3 wash d. W.C. del. Annot. **b** [*Physeter macrocephalus*] whole animal, l. lat.: 1 engr. Annot. **c** *Balaena mysticetus* stranded animal, l. lat.: 1 w.d. E. C. Blundell del.

424 **a,c,d,f** *Euphyseter macleayi* [*Kogia breviceps*] mounted skel. l. antero-lat. post. l. & r. lat. lat. **b** [*Balaenoptera physalus*] mounted skel. of young, l. lat. Annot. **e** [*Balaenoptera*] ? occiput.

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Annot. **g** *Balaenoptera, Physalus antarcticus* [*Balaenoptera physalus*] ♂, mouth propped open ant., Annot. 7 photos

425 **a,b** *Delphinus delphis* [*Tursiops truncatus*]: 2 c.d. autograph descr. **b** Annot. **c** [*Phocaena*] urethra: 1 i. sketch & autograph descr. **d** *Platanista* [*gangeticus*] *minor* sk. & m. r. lat.: 1 s.d. Annot. [HOLOTYPE of *P. minor* Owen 1853 *Descr. cat. osteological series . . . Royal College of Surgeons of England 2 Mammalia, Placentalia.* London p.9 R.C.S. No. 2481. Destroyed in 1939–1945 war]

426 **a** [*Physeter macrocephalus*] part of sk.: 1 p. sketch Annot. **b** [*Delphinus delphis*] lower jaw, l. lat. & occ.: 4 i. sketches. Annot. **c** sk. dors. & l. lat.: 2 i. sketches. Annot. **d** *Balaenoptera* petrotympanic, 2 views: 2 p.d. Annot. **e&h** [Cetacean unident.] occipital region & vomer: 2 i. sketches **f** [*Balaenoptera physalus*] occipital region: 1 p.d. F. F. Hasford del. Annot. **g** † *Zeuglodon* [*Basilosaurus*] tooth: 2 p. & i. sketches **i** *Ziphius* [*cavirostris*] part of snout: 2 p. & i. sketches. Annot.

427 [*Phocaena phocoena*] **a** head, sagittal section l. lat.: 1 i. sketch **b** head, sagittal section r. lat.: 1 w.d.

428 **a,b,d,e** [Small Balaenid – ? *Caperea*] fused cervical vertebrae, post. dors. ant. & vent.: 4 p.d. C. Galpin del. **c** *Balaena* fused cervical vertebrae, ant. vent.: 1 p.d. Annot.

429 **a,f** † [*Balaena*] occiput, 2 views: **f** Annot. **b** [Small Balaenid] occiput, post. Annot. **c** [*Balaenoptera*] occiput **d** *Physalus antiquorum* [*Balaenoptera*] radius, lat. Annot. **e** [Cetacean] ? scapula, eroded: Annot. **g** [Balaenid] part of dors. vertebra, post. Annot. **h1** [Physeteridae: genus unident.] vomer, proximal end: Annot. **h2** [Cetacean] Annot. **i** [Unident ? Cetacean] ? scapula, dors. **j** [*Balaena*] caudal vertebra, lat. [? *Bos*] horn cores **k** [*Balaena*] lumbar vertebra, ant. Annot. **l** [Cetacean] maxilla, proximal end: Annot. **a–l** 12 photos

430 *Phascolomys* [*Vombatus ursinus*] sleeping specimen, r. lat. & ant.: 3 wash d.

431 *Phascolomys* [*Vombatus ursinus*] vent.: 1 wash d.

432 **a,d** *Phascolomys* [*Lasiorhinus*] *latifrons** humerus, 2 views:* No. 1306 b **b,e** *Phascolomys platyrhinus* [*Vombatus ursinus*]* humerus, 2 views: *No. 1496 d, 4 p.d. P: *Trans. zool. Soc. Lond.* **8** 1874 pl.72 f.1–4 **c,g** † *Phascolomys* [*Phascolonus*] *gigas* mandibular symphysis **c** post. **g** lat. Annot. 3 c.d. J. Erxleben del. **c** P: *l.c.* f.3 **f1** † *Phascolomys* [*Phascolonus*] *gigas* **f2** *Phascolomys vombatus* [*Vombatus ursinus*] lower jaws, occ.: 2 w.d. J. Erxleben del. Annot. P: *Phil. Trans. R. Soc.* **162** 1872 pl.39 f.1 **h** *P.* [*P.*] *gigas* & *Phascolomys vombatus* [*Vombatus ursinus*] mandibular symphyses, vent.: 2 c.d. J. Erxleben del. P: *l.c.* pl.39 f.2,4. Annot. [**c, f1, g & h top** all same specimen SYNTYPE current whereabouts unknown, see Mahoney, J. & Ride, W. D. L. 1975 p.61]

433 † *Phascolomys* [*Phascolonus*] *gigas** **a,b** r. m. & teeth, labial & lingual: 2 c.d. J. Erxleben del. P: *l.c.* pl.36 f.1,2 *No. 43044

434 † *Phascolomys* [*Phascolonus*] *gigas** **a,b** m., occ. post.: 2 c.d. J. Erxleben del. P: *l.c.* pl.37 f.1; pl.38 f.1 *No. 43044

435 † *Phascolomys* [*Phascolonus*] *gigas** **a** incisor, l. lat. & transverse section **b** r. ramus & teeth, l. lat. *No. 35977 **c upper** tooth row, occ. Annot. **c lower** r. ramus, fractured surface, ant. post. *No. 43044. 7 w.d. J. Erxleben del. P: *l.c.* pl.40 f.2,4,1; pl.32 f.2,3

436 **a** *Lagotis cuvieri* [*Lagidium viscaccia*] vertebrae, dors. & lumbar, lat. view: 1 p.d. *Phascolomys* [*Vombatus*] *ursinus* vertebrae, dors. & lumbar, dors. view: 5 s.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.46 f.10; pl.47 f.12 **b** *Thylacinus harrisi* [*cynocephalus*] sk. pal.: 1 s.d. H.S. del. P: *Trans. zool. Soc. Lond.* **2** 1841 pl.70 f.1 **c** [*Vombatus ursinus*] pelvis, sacral & caudal vertebrae: 1 wash d. H.S. del. P: Todd, R. B. *The Cyclopaedia of Anatomy* . . . Lond. 1835–59 **3** f.102

437 [*Phascolarctos cinereus*] sitting on a branch, l. lat. view: 1 p.d.

438 [*Phascolarctos fuscus* [*cinereus*]] **a** sk. & lower jaw, lat., pal. & sagittal: 4 s.d. H.S. del. P: *Trans. zool. Soc. Lond.* **2** 1841 pl.69 **b** pelvis & marsupial bones ventro-lat.: 2 w.d. H.S. del. P: Owen, R. *Anat. of Vertebrates*, Lond. 1866 **2** f.227 **c** [*Phascolarctos cinereus*] 1st 3 vertebrae, scapula & humerus: 3 p. & w.d. H.S. del. P: *l.c.* f.216,224,225

439 **a** † [*Thylacoleo carnifex*] l. lower incisor, l. & r. lat. occ. & lingual: 5 p. & wash d. J. Erxleben del. P: *Phil. Trans. R. Soc.* **161** 1871 pl.13 f.5–8 *No. 42536 & Cast M 29478 **b** † *Thylacoleo* sk. reconstruction, l. lat.: 1 i. sketch R.O. del **c** † [*Thylacoleo carnifex*]* incomplete l. m. ramus, ant. & restoration of mandible, ant.: 1 w. & i.d. & 1 i. sketch P: *l.c.* pl.13 f.3 SYNTYPE of *T. oweni* *No. 39995 **d** † [*Thylacoleo carnifex*]* cast of r. ramus, lingual, labial & post.: 3 i. sketches G. H. Barrow del. W. H. Wesley lith. P: *l.c.* **178 B** 1887 pl.1 f.1–3 Cast *No. M 1957. Orig. specimen in A.M.S. No. F 53508 (B 2705). For further details see Mahoney & Ride 1975 : 53–57

440 **a** *Macropus major* [*giganteus*] l. innominate bone, l. lat.: 1 p.d. P: *l.c.* **174** 1883 pl.46 f.2 **b** † *Thy-*

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*lacoleo carnifex**, *Diabolus ursinus* [*Sarcophilus harrisii*] l. innominate bones, l. lat.: 2 p.d. **P**: *l.c.* pl.46, f.1,4 Cast *No. M 1523 **c** *Felis* [*Panthera*] *leo* l. innominate bone, l. lat.: 1 p.d. **P**: *l.c.* pl.46 f.3 **d** l. innominate bones of species on Fol. **440**: lithograph of pl.46 *l.c.*

441 † [*Thylacoleo carnifex*]* **a** l. maxilla, ccc. P: *l.c.* pl.39 f.1 **b** r. m., lingual P: *l.c.* pl.41 **c** l. m., labial P: *l.c.* pl.41 Annot. **d1,2,3** Cast of r. radius, lat. & end views P: *l.c.* pl.40 f.1–3 Cast *No. M 1525. Original specimen in A.M.S. No. A 13294 (F 16472) **d4** Casts of r. ulna & distal end P: *l.c.* pl.40 f.2,4. Cast *No. M 1526 original in A.M.S. No. A 13293 (F 5465) **d5** Cast of proximal end of l. ulna P: *l.c.* pl. 40 f.5 A.M.S. No. A 13305. [*Thylacoleo* [Marsupialia unident.]] **e** Casts of 3 ungual phalangeals, 6 views: **top** P: *l.c.* pl.40 f.6. Cast *No. M 1526 A.M.S. No. A 13293 (F 5465) **middle** Cast *M 1926 A.M.S. No. A 13318 **bottom** Cast *M 1536. A.M.S. No. A 13320 **f** ungual phalangeal, 3 views **top** & **left** P: *l.c.* pl.40 f.7,8. Annot. HOLOTYPE of † *Mylodon australis* Krefft A.M.S. No. F7323 **g** lower m. occ.: P: *l.c.* pl.39 f.2. 18 p.d. G.B. del.

442 † *Diprotodon* [*australis*]* **a** lower molars, occ.: 2 p. sketches R.O. del. Annot. **b,f** lower jaw, lat.: 2 p.d. **f** Annot. P: *Phil. Trans. R. Soc.* **160** 1870 pl.35 f.1. *No. 32851 **c** † *D. australis* & [*D. optatum*]* m. symphysis & base of r. incisor, lat. & frontal; 2 rough i. sketches, Annot. After Owen, R. in Mitchell, T. L. *Three expeditions into the interior of eastern Australia* . . . London 1838, **2** pl.31. HOLOTYPE of both *D. australis* & *D. optatum* *No. 10796. See Mahoney & Ride 1975 : 87 & 105. **d** † [*D. australis*] incomplete atlas vertebra, vent.: 1 i. sketch, Annot. **e** upper molars, lat. & occ.: 2 p. sketches. Annot. See Mahoney & Ride, 1975 : 87

443 **a** † *Diprotodon* l. upper molars in part of maxilla, l. lat. & occ.: 2 w.d. G.S. del. **b** † *Diprotodon* [*Dinotherium australe*] portion of l. ramus, lingual & occ.: 2 pen & wash d. ? T. L. Mitchell del. P: *Ann. Mag. nat. Hist.* **11** 1843 : 329–330. Annot. HOLOTYPE – whereabouts unknown. [Mentioned – Mahoney & Ride 1975]

444 **a** † *Diprotodon* [*australis*]* imperfect cranium, ant. & post. *No. 32851: cervical vertebrae, lat., *Nos 32852–4, axis No. 32870, scapula, *No. 32861, humerus *No. 32866 & femur. *No. 32864 13 p.d. T. L. Mitchell del. Annot. vertebrae & scapula P: *Phil. Trans. R. Soc.* **160** 1870 f.5 p.542 f.6 p.549. **b** † *Diprotodon* dors. vertebra, ant. & lat.: 2 p.d. H. Campbell del. Annot.

445 **a** † [*Palorchestes azael*]* sk. l. lat.: 1 outline p.d. C. L. Griesbach del. P: *l.c.* **166** 1876 pl.20. HOLOTYPE *No. 46316 Annot. [See also Fol. **451**] **b** † *Nototherium* [*Zygomaturus*] *victoriae* l. ramus, lingual: 1 s.d. J. Dinkel del. P: *l.c.* **162** 1872 pl.7 f.2 Cast HOLOTYPE of *victoriae* *No. M 3637 Original spec. S. Australian Mus. No. P4986

446 † *Nototherium* [*Diprotodon bennettii** Owen 1877] **a** r. lower incisor, lat. of longitudinal section: 1 p.d. C. L. Griesbach del. Annot. *No. 46057a **b** autograph description of **a** **e** r. ramus, labial: 1 i. & wash d. Annot. **c,d** † *Nototherium zygomaturus* [*Zygomaturus trilobus*]* sk. l. lat. & frontal: 2 i.d. Annot. HOLOTYPE of *trilobus* in A.M.S. No. F 4635. Cast *No. 32850

447 † *Nototherium mitchelli** **a,b** r. ramus & teeth, lat. occ. & vent.: 4 c.d. G.S. del. P: *l.c.* **162** 1872 pl.6. *No. 43952 **c** r. lower molars, occ.: 1 s.d. J. Dinkel del. P: *l.c.* pl.10 f.3. Annot.

448 † *Nototherium mitchelli* [*Zygomaturus trilobus*]* sk. & lower jaw, r. lat.: 1 i. & s.d. J. Dinkel del P: *l.c.* pl.2 f.1 *No. 33259

449 [? *Macropus giganteus*] **a** whole animal, foot & detail l. lat.: 3 w.d. **b** *Macropus major* [*giganteus*] r. lat.: engr. P: Hawksworth, J. *Voyages* . . . Lond. 1773 **3** pl.20. Annot.

450 † *Sthenurus brehus** **a** sk.: 4 p. & i. outline d. R.O. del. engr. by J. Erxleben P: *Phil. Trans. R. Soc.* **166** 1876 pl.28 f.1–5. *No. 44121 **b** palate & teeth, lat. & occ. 2 c.d. J. Erxleben del. P: *l.c.* **164** 1874 pl.27 f.5,6 *No. 43303 a SYNTYPE **c1** † *Sthenurus atlas* r. ramus, occ. **c2** †[*Macropus*] *titan* r. ramus, occ.: 2 p.d. P: *l.c.* pl.22 f.3,17[see also Fol. **452**] **d** † *Sthenurus brehus* l. lower incisor: 3 w.d. P: *l.c.* **166** 1876 pl.28 f.4

451 † *Palorchestes azael** **a** sk. restored l. lat.: 1 outline i.d. P: *l.c.* pl.20 **b** palate & cheek teeth, pal : 1 s.d. P: *l.c.* **164** 1874 pl.82 f.1 **c** palate, r. lat.: 1 s.d. P: *l.c.* pl.81 f.1. Annot. HOLOTYPE *No. 46316 [see also Fol. **445**]

452 **a1** † [*Sthenurus atlas*] r. ramus, part, occ. **a2** † [*Macropus titan*] r. ramus, part, occ.: 2 c.d. P: *l.c.* **164** 1874 pl.22 f.3,17 [see also Fol. **450**] **b1** † *Macropus* [*Sthenurus*] *atlas* restored l. ramus, lingual HOLOTYPE *No. M 10778 **b2** † *Macropus titan** l. ramus, lingual: 2 p.d. R.O. del. P: *l.c.* pl.22 f.4,18. Annot. HOLOTYPE *No. M 10777 **c1** † *Sthenurus atlas* l. lower molar, occ. **c2** † *Macropus titan* l. lower molar, occ.: 2 c.d. pl.20 f.30,29. Annot. **d** † *Sthenurus atlas** **left**: maxillary tooth row, 2 lat.: mandibular tooth row, occ. Annot. *No. 45934 **right**: subjects as above. Annot. *No. 40001 6 w.d. J. Erxleben del. P: *l.c.* pl.24 f.4–8

453 **a** [Macropodidae unident.] incisor, ant. & post. **b** † *Macropus titan* r. upper cheek teeth: Annot. P: Owen, R. *Res. fossil remains extinct mammals of Australia* Lond. 1877 pl.8 f.11 **c,d** † *Macropus*

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titan r. mandibular & maxillary tooth rows, occ.: P: *Phil. Trans. R. Soc.* **164** 1874 pl.23 f.13,3 **e** † *Sthenurus* sp. maxillary teeth, l. & occ. Annot. † *Sthenurus brehus* **f** molars 2 & 3 occ. Annot. **g** upper molars 1 & 2. Annot. **h** *Macropus rufus* tooth rows, lower & upper, occ. P: *l.c.* pl.21 f.2,4 † [*Protemnodon anak*]* **i** maxillary tooth row, occ.: P: *l.c.* pl.23 f.8 **j** incomplete mandibular ramus & teeth, occ. & lat. P: *l.c.* pl.25 f.1,2. HOLOTYPE *No. M 1895 **k** † [*Macropus*] *titan** incomplete ramus & teeth, occ. & lat. P: *l.c.* pl.21 f.12–24. *No. M 1894 **l** † *Procoptodon* [*Macropus*] *goliah* fragment of ramus & teeth, lat. r. occ. P: *l.c.* pl.80 f.8 **a–l** 20 w.d.

454 † *Macropus* **a** skel. r. lat.: 1 p.d. **b** *Macropus parryi* vertebrae, r. lat.: 1 p.d. P: *l.c.* **141** 1851 pl.47 f.13 **c** † *Macropus titan* part of m. & molars, l. lat. & occ.: 1 w.d. P: *l.c.* pl.26 f.9

455 **a,b** [*Vombatus ursinus* & *Macropus*] hearts, diss. to show chambers: 2 p.d. P: Owen, R. *Anat. of Vertebr.* London 1868 **3** p.519,518 **c** [*Macropus*] heart, to show vessels: 1 i.d. Annot. **d** *Macropus major* [*giganteus*] ♂ urinogenital system 1 wash d. **e** [*Macropus* or *Castor*] brain diss. lat.: 1 w.d. Annot.

456 **a** [Didelphidae] **c** [Vombatidae] **f** *Phascolarctos* [*cinereus*] **g** [Macropodidae] caecum of each 4 s.d. P: Todd, R. B. *The Cyclopaedia of Anatomy . . .* Lond. 1835–59 **3** f.110 **b** *Phascolomys* [*Vombatus* or *Lasiorhinus*] & *Phascolarctos* [*cinereus*] glans penis: 2 p.d. P: Owen, R. *Anat. of Vertebr.* Lond. 1868 **3** p.646 **d,e** *Phascolarctos* [*cinereus*] **d** ileo-caecal valve P: *l.c.* p.418 **e** liver P: *l.c.* p.482: 2 s.d.

457 [*Bettongia*] skel. lat.: 1 w.d.

458 *Hypsiprymnus myosurus* [*Potorous tridactylus*] mounted skel. r. lat.: 1 s.d. H.S. del.

459 **a** *Hypsiprymnus setosus* [*Bettongia penicillata*] sk. dors. pal. & l. lat.: 3 i. & w.d. H.S. del. part P: Owen, R. *Odontography* Lond. 1840–45 **2** pl.100 f.7. Annot. **b** *Hypsiprymnus* [*Potorous*] ♂ urinogenital system: 1 w.d. T. R. Jones del. P: Owen, R. *Anat. of Vertebr.* Lond. 1868 **3** f.503 **c** *Hypsiprymnodon moschatus* living specimen, lat. & frontal: 1 w.d. J. Wolf del. P: *Trans. Linn. Soc. Lond.* (2) Zool. **1** 1879 pl.71 **d** *Hypsiprymnus* [*Potorous*] pelvis of young: 1 wash d. P: Todd, R. B. *The Cyclopaedia of Anatomy . . .* Lond. 1835–59 **3** f.110 **e** *Hypsiprymnodon murinus* [*Potorous tridactylus*] sk. dors. pal. & l. lat.: 3 i. & s.d. H.S. del. Annot.

460 **a** [*Perameles* [*Macrotis*] *lagotis*] **a top** sk. & lower jaw, pal. & occ. P: Owen, R. *Anat. of Vertebr.* Lond. 1866 **2** p.346 **a lower** *Thylacomys tenuirostris* [? *Macrotis lagotis*] sk. & lower jaw, l. lat.: P: Owen, R. *Odontography* Lond. 1840–45 **2** pl.98 f.5, 3 d. **b** *Thylacomys longirostris* [*Macrotis lagotis*] sk. l. lat. & pal.: 2 p.d. R.O. del **c** *Thylacomys radiatus* [*Isoodon*] skel. l. lat.: 1 s.d. H.S. del. verso Annot.

461 **a** [Macropodidae] sk. pal.: 1 p.d. **b** *Phalangista vulpina* [*Trichosurus vulpecula*] muscles of leg: 1 p.d. P: Owen, R. *Anat. of Vertebr.* Lond. 1868 **3** p.15 **c** *Perameles* [*bougainville*] sk. l. lat.: 1 i. outline d. Annot. Copy of d. P: Quoy, J. R. C. & Gaimard, J. P. 1824 *Voyage autour du Monde . . . l'Uranie et la Physicienne*. Paris. Zool. Atlas pl.5 **d** [*Cercartetus nanus*] sk. dors. skel. & sk. l. lat.: 3 p.d. H.S. del. **e** *Didelphys virginiana* [*Didelphis marsupialis*] vertebrae, 3 views: 3 w.d. P: Todd, R. B. *The Cyclopaedia of Anatomy . . .* Lond. 1835–59 **3** f.100,101 **f** *Phascogale flavipes* alimentary canal: 1 w.d. P: *l.c.* f.122

462 **a** [? *Didelphis*] abdominal musculature & marsupial bones: 1 p. sketch W.C. del. **b** 'Spotted cavy' [? *Dinomys*] **c** *Petaurus pigmaus* [*pygmaeus*] **d,f** [*Didelphis marsupialis virginianus*] All diss. of ♀ organs: **b–d** 3 p. & i.d. **f** 1 w.d. Annot. **e** [foetus, unident.] 1 i. sketch. Annot.

463 **a** † *Thylacotherium* [*Amphitherium prevosti*]* l. ramus with teeth, diss. to show roots: 1 w.d. P: *Trans. geol. Soc. Lond.* **6** 1842 pl.5 f.3. Cast *No. M 26243 Original in Oxford Univ. Mus. **b** as **a** Cast of l. ramus with teeth, lingual: 1 w.d. P: *l.c.* pl.5 f.1 Cast *No. M 26244 Original in Oxford Univ. Mus. **c** † *Amphitherium* [*prevostii*]* r. ramus with teeth, labial: 1 w.d. R.O. del. Annot. Cast *No. M 26242 of HOLOTYPE in Oxford Univ. Mus. Enlarged model *No. M 5967 **d** *Myrmecobius* [*fasciatus*]* r. ramus, lingual: 1 w.d. *No. 314b = 55.12.24.71 **e** † *Thylacotherium* [*Amphilestes broderipi*] l. ramus with teeth, lingual: 1 w.d. **f** † *Phascolotherium* [*bucklandi*]* r. ramus with teeth, lingual: 1 w.d. HOLOTYPE *No. 112. All except **c** C. M. Curtis del. All P: Owen, R. *Hist. Brit. foss. mammals & birds* Lond. 1846 f.15–20

464 **a** † [*Triconodon* [*Trioracodon ferox*]]* r. ramus & teeth, r. lat.: 3 d. P: pl.3 f.14. *No. 47774 **b** † [*Spalacotherium tricuspidens*]* l. ramus & teeth, incomplete lat.: 2 p.d. P: pl.1 f.38. *No.47750 **c** † [*Microlestes* [*Haramiya*] *moorei*] lower molars: 2 d. P: pl.1 f.8&8A. Bath Mus. No. M 222 **d** † [*Spalacotherium tricuspidens*]* r. ramus with teeth, lat. & occ.: 5 p.d. P: pl.1 f.36,37. *Nos 47749a & 47749b **e** [*Microlestes* [*Haramiya*] *moorei*] tooth, occ. & lat.: 2 d. P: pl.1 f.7&7A. Bath Mus. No. M 216 **f** † [*Spalacotherium tricuspidens*]* l. m. ramus in block, l. lat.: 2 p.d. P: pl.1 f.35. *No. 47748 **g** † [*Microlestes* [*Haramiya*] *moorei*] molar, occ.: 2 d. P: pl.1 f.6. LECTO-

Folio

TYPE Bath Mus. No. M 211. †[*Stereognathus ooliticus*]* **h** m. fragment with teeth in matrix, lat. & occ.: 2 w.d. P: pl.1 f.27. HOLOTYPE in Inst. Geol. Sci. Lond. No. GMS 113834 Cast *No. M 4000 **i** teeth of **h**, 3 views: 3 w.d. P: pl.1 f.29 **j** † [*Microlestes* [*Haramiya*] *moorei*] upper molar, labial: lower molars, occ. & lat.: upper canine, lat.: 7 d. P: pl.1 f.5,9–13. Bath Mus. Nos M 212, M 213, M 214, M 217 **k** † [*Spalacotherium tricuspidens*]* incomplete l. ramus & molars, lab. & occ.: 3 pen, p. & w.d. P: pl.1 f.32. HOLOTYPE *No. 46019 **l** † [*Stereognathus ooliticus*]* molar, lingual: 1 w.d. P: pl.1 f.28. HOLOTYPE see Fol. **464 h** **m** [*Myrmecobius fasciatus*] upper & lower molars, occ.: 2 p.d. P: pl.1 f.19,20 **n** † [*Microlestes* [*Haramiya*] *moorei*] molar, 4 views: 4 p.d. P: pl.1 f.1–4. Bath Mus. No. M 215 **o** † [*Hypsiprymnopsis rhaeticus*] tooth, [? molar], lat.: 3 p.d. I. Phillips del. P: pl.1 f.16 Annot. [Specimen now lost.] **p17** [*Hypsiprymnus murinus* [? *Potorous tridactylus*]] 4th lower premolar, lat. **p18** [*Bettongia penicillata*] 4th lower premolar, lat.: 2 p. & i.d. P: pl.1 f.17,18. All A. T. Hollick del. except where otherwise stated. All P: Owen, R. *Monogr. fossil Mammalia . . . Mesozoic formations. Palaeontogr. Soc.* (*Monogr.*) 1871

465 **a** † *Peralestes longirostris* [*Phascolestes mustelula*]* r. maxilla & teeth, r. lat.: 3 d. P: pl.2 f.3. *No. 47740 HOLOTYPE of *P. longirostris* **b** † *Peraspalax* [*Amblotherium*] *talpoides** l. ramus, r. lat.: HOLOTYPE *No. 47738 *Didelphis* [*Philander*] *opossum* lower molar, labial: 4 p.d. W.W. del. P: pl.2 f.9 **c** † *Amblotherium* [*Phascolestes*] *mustelula** r. ramus & teeth, l. lat.: 2 d. P: pl.2 f.2. *No. 47753 HOLOTYPE of *P. mustelula* **d** † [*Achyrodon pusillus*] [*Amblotherium pusillum*]* incomplete, ramus & teeth, r. lat.: 2 d. P: pl.2 f.8. HOLOTYPE of *A. pusillus* *No. 47747 **e** † *Amblotherium soricinum* [*pusillum*]* r. ramus & teeth, l. lat.: 3 d. P: pl.2 f.1. HOLOTYPE of *A. soricinum* *No. 47752 **f** † *Achyrodon nanus* [*Amblotherium pusillum*]* incomplete l. ramus & teeth, r. lat.: 3 d. P: pl.2 f.7. *No. 47783 **g** † *Phascolestes dubius* incomplete r. ramus & teeth, l. lat.: 2 d. P: pl.1 f.41. *No. 47737 **h** † *Achyrodon nanus* [*Amblotherium pusillum*]* incomplete ramus & teeth, l. lingual: 2 d. P: pl.2 f.6 *No. 47746 **i** † *Spalacotherium minus* [*Peramus tenuirostris*]* l. ramus & teeth: l. lat.: 2 d. P: pl.1 f.39 (see also **k**). HOLOTYPE of † *Spalacotherium minus* *No. 47751 **j** † *Achyrodon nanus* [*Amblotherium pusillum*]* incomplete r. ramus, lat.: 2 d. P: pl.2 f.5. HOLOTYPE of † *Achyrodon nanus* *No. 47745 **k** † *Spalacotherium minus* [*Peramus tenuirostris*]* l. ramus with teeth, r. lat.: 2 d. P: pl.1 f.39. Annot. HOLOTYPE of † *Spalacotherium minus* *No. 47751 (see also **i**) **l** † *Peralestes* (*Phascolestes*) *longirostris* [*Phascolestes mustelula*]* incomplete l. ramus & teeth, l. lat.: 3 p.d. W.W. del. P: pl.2 f.4. Annot. *No. 47741 All p.d. except **b** & **l**. All A. T. Hollick del. All P: *l.c.* See last line Fol. **464**

466 † *Stylodon pusillus* [*Amblotherium pusillum*]* **a** incomplete ramus & teeth, l. lat.: 2 d. P: pl.2 f.16. *No. 47756 **b** incomplete l. ramus & teeth, l. lat.: 2 d. P: pl.3 f.3. *No. 47761 **c** † *Stylodon* [*Kurtodon*] *pusillus** incomplete r. maxilla & teeth, l. lat.: P: pl.2 f.14. *No. 47755 HOLOTYPE **d** † *Stylodon pusillus* [*Amblotherium nanum*]* incomplete ramus & teeth, l. lat.: 2 d. P: pl.3 f.2. *No. 47760 **e** † *Peramus minor* [? *tenuirostris*]* incomplete ramus & teeth, r. lat.: 2 d. P: pl.2 f.13. *No. 47754 HOLOTYPE of *P. minor* **f** † *Stylodon robustus* [*Amblotherium pusillum*]* incomplete l. ramus & teeth, l. labial: 2 d. P: pl.3 f.1. *No. 47762 HOLOTYPE of *S. robustus* **g** † *Peramus tenuirostris** incomplete l. ramus, l. labial: 2 d P: pl.2 f.12. *No. 47744 **h** † *Stylodon pusillus* [*Amblotherium pusillum*]* incomplete l. ramus & teeth, l. lat.: 2 d. P: pl.2 f.19. *No. 47759 **i** † *Peramus tenuirostris** incomplete l. ramus & teeth, l. labial: 2 d. P: pl.2 f.11 *No. 47743 **j** † *Stylodon pusillus* [*Amblotherium nanum*]* incomplete ramus & teeth in matrix, l. lat.: 2 d. P: pl.2, f.18. *No. 47758 **k** † *Peramus tenuirostris** incomplete l. ramus & teeth, l. lat.: 3 d. P: pl.2 f.10. HOLOTYPE *No. 47742 **l** † *Stylodon pusillus* [*Amblotherium pusillum*]* incomplete l. ramus with teeth, l. lat.: 2 d. P: pl.2 f.17. *No. 47757. All p.d. All A. T. Hollick del. All P: *l.c.* See last line Fol. **464**

467 **a** † [*Triconodon mordax* [*Trioracodon oweni*]]* imperfect r. ramus, lingual: 2 d. P: pl.3 f.9. HOLOTYPE of *Trioracodon oweni* *No. 47766 **b** † [*Triconodon*] imperfect ramus, lat.: 2 d. P: pl.3 f.16. *No. 47769 **c** † *Triconodon mordax* [*Trioracodon ferox*]]* imperfect ramus with teeth & tooth magnified, lat.: 2 d. P: pl.3 f.8. *No. 47765. † [*Triconodon mordax*]* **d** imperfect r. ramus with teeth, lat.: 2 d. P: pl.3 f.15. *No. 47768 **e** l. ramus with teeth, l. lat.: 2 d. P: pl.3 f.7. HOLOTYPE *No. 47764 **f** † *Triconodon* [*Trioracodon*] *ferox** imperfect ramus, l. lat.: 1 d. P: pl.3 f.13. *No. 47777 a **g** † [*Bolodon crassidens* [*elongatus*]]* teeth in matrix & teeth magnified, oblique & lat.: 3 d. P: pl.3 f.6. HOLOTYPE of *Bolodon elongatus* *No. 47736 **h** † [*Triconodon* [*Trioracodon*] *ferox*]* imperfect ramus & teeth, r. lat.: 1 d. P: pl. 3 f.12. *No. 47776 **i** † [*Bolodon crassidens*]* imperfect r. maxilla & teeth, r. lat. & occ.: 3 d. P: pl.3 f.5. HOLOTYPE *No. 47735 **j** † *Triconodon* [*Trioracodon*] *ferox** l. ramus & teeth, M2 magnified, r. lat.: 3 d. P: pl.3 f.11. HOLOTYPE *No. 47775 **k** † [*Leptocladus dubius* [*Peramus tenuirostris*]]* imperfect ramus & teeth,

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l. lat.: 2 d. P: pl.3 f.4. HOLOTYPE of _Leptocladus dubius_ *No. 47739 **l** † _Triconodon mordax_* imperfect r. ramus & teeth, r. lat.: 2 d. P: pl.3 f.10. *No. 47767. All p.d. All A. T. Hollick del. All P: _l.c._ See last line Fol. **464**

468 **a** † _Triconodon_ [_Trioracodon_] _ferox_* crushed sk. in matrix, enlarged upper tooth & l. & r. rami, general & lat.: 4 d. P: pl.4 f.1. *No. 47781 **b** † [_Triacanthodon serrula_ [_Triconodon mordax_]]* r. ramus with teeth, r. lat.: 2 d. P: pl.4 f.7. HOLOTYPE of _T. serrula_ *No. 47763 a. (see also Fol. **469 j)** **c** † [_Triconodon_ [_mordax_]]* imperfect r. ramus with teeth, lat.: 1 d. P: pl.3 f.21. *No. 47768 **d** † [_Triconodon minor_ [_mordax_]]* incomplete ramus with teeth, teeth enlarged: 2 d. P: pl.4 f.6. HOLOTYPE of _T. minor_ *No. 47771 **e** † [_Triconodon_ [Dryolestidae incertae sedis]]* incomplete l. ramus with teeth, 1 tooth enlarged: 2 d. P: pl.3 f.20. *No. 47770 **f** † [_Triconodon_ [_mordax_]]* part of r. maxilla with 2 molars, lat. & occ.: 4 d. P: pl.4 f.5. *No. 47784 † [_Triconodon_ [_Trioracodon_] _ferox_]* **g** incomplete ramus with 2 teeth, l. lat.: 2 d. P: pl.3 f.19. *No. 47780 **h** incomplete ramus with 1 tooth, l. lat.: 1 d. P: pl.4 f.4. *No. 47773 **i** part of maxilla with teeth, tooth-row enlarged, lat. lingual & labial: 3 d. P: pl.3 f.18. *No. 47778 **j** † [_Triconodon_ [_Trioracodon_] _major_] incomplete l. ramus with teeth, r. lat.: 1 d. P: pl.4 f.3. HOLOTYPE *No. 40722 **k** † [_Triconodon_ [_Trioracodon_] _ferox_]* incomplete maxilla with teeth, lingual: 2 d. P: pl.3 f.17. *No. 47779 **l** † [_Triconodon occisor_ [_Trioracodon ferox_]]* incomplete lower rami with teeth in matrix, teeth enlarged, l. lat.: 3 d. P: pl.4 f.2. *No. 47782 HOLOTYPE of _T. occisor_ All p.d. All A. T. Hollick del. All P: _l.c._ See last line Fol. **464**

469 **a** [_Rana boans_ [? _catesbeiana_]] part of small cranium, nat. size, l. lat.: 1 p.d. L.A. del. Annot. P: R.O. 1847 _Rep. Br. Ass. Advmt. Sci. 1846_ p. 213 **b** † _Leptolestes_ incomplete ramus with teeth, lat.: 1 w.d. **c1** † [_Triconodon mordax_]* incomplete ramus with teeth in matrix, l. lat.: 1 w.d. P: pl.3 f.21. *No. 47772 Annot. **c2** † [_Palaeospalax magnus_ [_Desmana moschata_]]* incomplete l. ramus with teeth, l. lat.: 1 engr. P: Owen, R. _Hist. Brit. fossil mammals & birds_ Lond. 1846 f.12. HOLOTYPE of _Palaeospalax_ *No. 16120 **c3** [_Solenodon_] l. ramus with teeth, l. lat.: [R.O. del. L. Aldous engr.] 1 engr. Annot. P: Owen, R. _Odontography_ 1840–45 pl.111 f.1 **d** † [_Plagiaulax becklesi_]* incomplete r. ramus with teeth: 2 d. P: pl.4 f.11. HOLOTYPE *No. 47731 (see also **f**) **e** † [_Plagiaulax_ [_Ctenacodon_] _falconeri_]* imperfect r. ramus with teeth, r. lat.: 2 d. P: pl.4 f.16. HOLOTYPE *No. 47730 † [_Plagiaulax becklesi_]* **f** imperfect r. ramus: 5 d. P: pl.4 f.10. HOLOTYPE *No. 47731 (see also **d**) **g** fragment of l. ramus with teeth, l. lat.: 3 d. P: pl.4 f.15. *No. 47734 **h** † [_Plagiaulax_ [_Ctenacodon_] _minor_]* imperfect r. ramus with teeth, lat. & occ.: 3 d. P: pl.4 f.9. HOLOTYPE *No. 47729 [drawn before specimen damaged] **i** † [_Plagiaulax becklesi_]* fragment of r. ramus with teeth, l. & r. lat.: 4 p.d. P: pl.4 f.13,14. *No. 47732 **d–i** All A. T. Hollick del. **j** † [_Triacanthodon serrula_ [_Triconodon mordax_]]* l. ramus with teeth, l. lat.: 2 d. W. W. del. P: pl.4 f.8. HOLOTYPE of _T. serrula_ *No. 47763b [drawn before spec. developed] **k** † [_Plagiaulax becklesi_]* fragment of ramus with teeth, lat. & occ.: 3 d. P: pl.4 f.12. *No. 47733. All except **b, c** p.d. All except **c** P: Owen, R. _Res. fossil remains extinct mammals Australia . . ._ Lond. 1877

470 **a,b** [_Ornithorhynchus anatinus_] dors. & vent.: 2 s.d.

471 [_Ornithorhynchus anatinus_] **a** tail, dors. & vent.: **b** complete animal, l. lat.: 3 c.d. Annot.

472 [_Ornithorhynchus anatinus_] **a** vent. diss. to show mammary tissue: 1 p.d. Annot. **b** hind foot & leg muscles: 1 p.d. **c** vent. diss. showing viscera: 1 p. & w.d. J. W. Lewin del.

473 _Ornithorhynchus paradoxus_ [_anatinus_] **a,e,g** limb diss.: 3 p. sketches R.O. del. **a,e** Annot. **b** lower jaw & tongue complete, dors.: 1 w.d. **c** foot, vent.: 1 wash d. **d** diss. of pelvic girdle & caudal vertebrae: 1 p. & wash d. **f** young, frontal, lat. & vent.: 5 w.d. [T. R. Jones del.] P: _Trans. zool. Soc. Lond._ **1** 1835 pl.32 f.1–5 **h** live animal in 5 positions 5 p.d. ? sketches for _l.c._ pl.34

474 _Echidna hystrix_ [_Tachyglossus aculeatus_] with young in pouch, vent.: 1 c.d. J. Wolf del. P: _Phil. Trans. R. Soc._ **155** 1865 pl.39

475 _Echidna hystrix_ [_Tachyglossus aculeatus_] **a,b** parts of fore & hind limbs, diss. to show muscles **c,d,e** dissected impregnated uterus & uterine ovum: **c–e** 3 p.i. & w.d. P: _Ann. Mag. nat. Hist._ (5) **14** 1884 pl.13. Annot. **f** _Echidna setosa_ [_Tachyglossus setosus_] submaxillary salivary glands diss.: 1 p.d. P: Owen, R. _Anat. of Vertebrates_ Lond. 1866 **3** p.397 **g Top 1&2** † _Echidna_ [_owenii_* Krefft, 1868] fragment of r. humerus, 2 views; A.M.S. No. F 11017 *Cast M 1908, HOLOTYPE of _E. owenii_ & _E. gigantea_ Roger 1887 [see Mahoney & Ride 1975 : 28] **top 3** Thylacine [_Thylacinus_] metatarsal ? **top 4&5** † _Thylacoleo_ 2 jaw fragments **lower 1&3** Echidna recent [Tachyglossidae] imperfect femur A.M.S. No. F10888 **lower 4&5** _Thylacoleo_? 2 bones. 1 photo (with inch scale) from A.M.S. _Tachyglossus_ **h** half sk. sagittal: 1 p.d. **i** rostrum: 3 wash sketches **j** sk., lat. & 3 parts; 3 s & 1 p.d. P: _l.c._ **2** p.312 & _Rep. Br. Ass. Advmt Sci._ 1846 [1847] p.198 f.12 **k** lumbar vertebra, 2 views: 2 p.d. P: Owen, R. _Anat. of Vertebrates_ Lond. 1866 **2** p.316 f.200 **l** _Echidna_

Folio

setosa [*Tachyglossus setosus*] ramus, fore & hind limb skel.: 3 p. & s.d. P: *loc. cit* **2** pp.312,325,328, f.197,207,210

476 **1a–c** † Moas [Dinornithiformes] 8 mounted skel. **a** frontal **b** lat. **c** dors. **a–c** 3 photos **a** P: Duff, R. *Pyramid Valley Waikari* . . . Christchurch, N.Z. 1949 p.9, shows Julius von Haast, founder of Canterbury Mus. with Glenmark skels in Canterbury (N.Z.) Mus. photo. by Dr. A. C. Barker.

477 † *Dinornis maximus** **pl.79** femur & tarso–metatarsus **pl.80** tibia: proofs of lithographs J. Dinkel del. P. Owen, R. *Mem. . . . extinct wingless birds of N.Z.* . . . Lond. 1878 pl.79,80. Casts *No. A 161 SYNTYPES?

478 **a** 8 mounted skels from l. to r.: **a1** † *Dinornis gracilis* [*novaezealandiae*] **a2** † *Meionornis* [*Anomalopteryx*] *didiformis* **a3** † *Meionornis* [*Emeus*] *casuarinus* **a4** † *Palapteryx* [*Emeus*] *crassus* **a5** † *Dinornis maximus* **a6** † *Euryapteryx rheides* [? *gravipes*] **a7** † *Palapteryx* [*Euryapteryx*] *elephantopus* **a8** † *Euryapteryx gravipes* **a3,a4,a7** frontal, all others lat.: 1 photo. Annot. **b** 7 mounted skels from l. to r.: **b1** † *Dinornis* [*Emeus*] *crassus* **b2** † [? *Dinornis ingens*] **b3** [? *Apteryx*] **b4** † *Dinornis* [*Anomalopteryx*] *didiformis* **b5** † [? *Pachyornis* [*Euryapteryx*] *elephantopus*] **b6** † [*Dinornis*] *robustus* [*ingens*] **b7** † *Dinornis* [*Emeus*] *casuarinus* **b4,b5,b6** frontal; others lat. 1 photo. Annot.

479 **a** *Dromaeius* [*Dromaius*], *Casuarius* & *Rhea* **b** *Struthio* & † *Dinornis robustus* [*ingens*] All mounted skels lat.: 2 photos **a,b** Annot.

480 **a,b,c** † *Dinornis* [*Anomalopteryx*] *didiformis*, † *Dinornis gracilis* [*novaezealandiae*] † *Dinornis* [*Emeus*] *casuarinus* sk. dors. post. & lat.: 3 photos **e,f,g** † *Dinornis* [*Emeus*] *crassus*, † *Dinornis* [*Euryapteryx*] *elephantopus* sk. dors. post. & lat.: 3 photos **d** † [*Dinornis*] leg & foot, articulated: l. lat.: 1 photo.

481 **a,b** † *Dinornis maximus* frontal & r. lat.: 2 photos

482 **a,b** † *Dinornis* [*Emeus*] *casuarinus* mounted skel. r. lat. & frontal. Annot. **c** † *Meionornis* [*Emeus*] *casuarinus* mounted skel. frontal **d** † *Dinornis* [*Emeus*] *casuarinus* mounted skel. l. lat.: 4 photos

483 **a,b** † *Dinornis* [*Anomalopteryx*] *didiformis* mounted skel. frontal & r. lat. Annot. **c,d** † *Dinornis* [*Emeus*] *crassus* mounted skels, frontal & r. lat.: 4 photos. Annot.

484 **a,b** † *Dinornis giganteus* mounted skels, frontal & r. lat.: 2 photos. Annot.

485 **a,d** † *Palapteryx* [*Euryapteryx*] *elephantopus* mounted skels, frontal & r. lat.: 2 photos of specimens in Canterbury Mus. N.Z. **b** † *Dinornis* [*Euryapteryx*] *elephantopus* mounted skel. l. lat.: 1 photo. Annot. **c** † *Dinornis gracilis* [*novaezealandiae*] mounted skel. l. lat.: 1 photo. Annot.

486 **a,b** † *Dinornis robustus* [*ingens*] mounted skel. frontal & l. lat.: 2 photos. Annot.

487 † *Dinornis robustus* [*ingens*] **a** sacrum, sternum, fibula, ribs, toe with sole of foot **b** parts of skel. including sk., sternum, femur, ? tarso–metatarsus, ? pelvis **c** ischium, pubis, sternum & ribs of young: 3 photos. Annot.

488 † *Dinornis robustus* [*ingens*] **a,c** mounted skel. frontal & r. lat.: 2 photos. Annot. **b** skel. separated parts: 1 photo of 18 d.

489 **a,b** † *Dinornis ingens* tarso–metatarsus with integument: 2 photos by Burton Bros. Annot.

490 **a** † *Dinornis maximus** skel. l. lat.: 1 w.d. Annot. ? *No. 46050 **b** † *Dinornis* [*Euryapteryx*] *elephantopus** skel. l. lat.: lithograph by J. Erxleben. Annot. P: *Trans. zool. Soc. Lond.* **4** 1853 pl.46. *No. A 3620 mixed individuals – tarso-metatarsus LECTOTYPE. [See Archey, G. 1941 : 36]

491 † *Dinornis rheides* [? *Emeus casuarinus*] sternum, **a** post.: 1 wash d. J. Erxleben del. P: *l.c.* **7** 1870 pl.9 **b,d** r. lat. & frontal P: *l.c.* pl.8 f.2,1 **c** ant. border P: *l.c.* pl.9

492 **a–c** † *Dinornis* [*maximus*] cast of brain, lat. dors. & vent.: 3 i. outline d. prelim. sketches P: *l.c.* pl.45 f.11–13. Annot. **d** † *Dinornis rheïdes* [? *Emeus casuarinus*] sternum: 2 p. & i. outline sketches. R.O. del. Annot. **e** † *Dinornis* [*Euryapteryx*] *elephantopus* & *Struthio camelus* comparative dimensions of eggs: 1 i. outline d.

493 **a** [† Dinornithiformes] femur, ant. & post. (verso): 2 p.d. Annot. **b** † *Cnemiornis calcitrans** *No. 46586. † *Aptornis* [*didiformis*]* *No. 21609. † *Dinornis geranoides* [*Euryapteryx pygmaeus*] femurs, frontal & proximal end view of each: 6 p.d. R.O. del. P: *l.c.* **5** 1866 pl.65 **c** † *Cnemiornis* [*calcitrans*]* *No. 46587 tibia, fibula & humerus: 10 p.d. R.O. del. P: *l.c.* pl.66 [*No. 46586 & 46587 SYNTYPES of *C. calcitrans.*]

494 † *Palapteryx geranoides** [*Euryapteryx pygmaeus*]* **a** sk. fragments, nine views: 9 i. & w.d. R.O. del. P: *l.c.* **3** 1848 pl.54 HOLOTYPE of *P.g.* *No. 21687. Premaxilla & m. *Nos 21693, 21694 **b** calvarium, upper surface: 1 wash d. P: *l.c.* pl.53 f.7. *No. 21688 **c** † *Aptornis* [*otidiformis*]* cranium, 6 views: 6 w.d. J. Erxleben del. P: *l.c.* pl.52. *No. 21684

495 † *Dinornis* [*Megalapteryx*] *didinus** **a,e** r. foot, lat.: 2 c.d. P: *l.c.* **9** 1883 pl.61, 60 HOLOTYPE

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*No. A 16 **b–d** † *Dinornis robustus* [*ingens*] r. foot, inner toe, proximal, vent. & lat.: 3 s.d. J. Dinkel del. P: *l.c.* **6** 1868 pl.88

496 **a** † *Dinornis robustus* [*ingens*] & *Dromaius ater* [*diemianus*] skel. parts to show comparative sizes: 2 p. & wash d. R.O. del. **b** † *Porphyrio* & *Notornis* [*Porphyrio*] sk. & m. vent. dors. & lat.: 16 s. & i.d. [J. Dinkel del.] P: *l.c.* **3** 1848 pl.56

497 **a,b** [*Apteryx*] mounted skel. l. lat. & r. fronto-lat.: 2 photos

498 [*Apteryx australis*] **a** brain, 3 diss. to show optic nerve, l. lat.: T. Godart del. 1848 P: *l.c.* **7** 1871 pl.45 f.5; pl.46 f.1,2 **b** brain, vent. diss. P: *l.c.* pl.45 f.3,4 **c** tarso–metatarsus, post. & lat. R.O. del. **d** cloaca of ♂ **e,f** brain, 5 diss. P: *l.c.* pl.45 f.6–9 **g** brain in situ, dors. T. Godart del. P: *l.c.* pl.45 f.2 **h** wing defeathered: H.S. del. P: *l.c.* **2** 1840 pl.47 f.4 **i** head of ♂, sagittal **j** head, diss. to show musculature, l. lat. P: *l.c.* **7** 1871 pl.46 f.3,4 **k** brain, diss. to show olfactory nerves P: *l.c.* pl.45 f.1 **a–k** 17 p.i. & w.d.

499 [*Apteryx australis*] **a–b** lung, diss. to show air sacs **d** digestive system, diss.: 3 w.d. P: *l.c.* **2** 1840 pl.51 **e** ♀ reproductive system 2 w.d. P: *l.c.* **3** 1846 pl.36 **f** digestive urinary & reproductive organs of ♂ 2 c.d. P: *l.c.* **2** 1840 pl.50. All H.S. del. **c** [*Giraffa*] gall bladder, diss.: 1 s.d. H.S. del. P: *l.c.* pl.42 f.4

500 [*Apteryx australis*] **a,c,d,f** muscles of feet: 4 p. & w.d. R.O. & H.S. del. P: *l.c.* **3** 1846 pl.32,33 **b** spinal muscles of thoracic region: 1 w.d. P: *l.c.* pl.32 **e** sternum, ant. & post.: 1 p.i. & w.d. P: *l.c.* **2** 1840 pl.55 f.2,3 **g** abdominal sacs: 1 p.w.d. P: *l.c.* pl.49

501 **a** [*Columba*] crop, inverted to show interior surfaces: 1 i. sketch. Annot. **b** *Rhea* & *Dromiceius* [*Dromaius*] skel. of thoracic region: 2 p. sketches **c** *Dromiceius* [*Dromaius*] intestines: 1 c.d. Annot.

502 † *Cnemiornis calcitrans** **a,d** mounted skel. r. latero-frontal: *No. 75.12.15.1–33. **b,c** † *Cnemiornis* sternum & pelvis, frontal & lat.: 4 photos

503 † *Cnemiornis calcitrans** sk. **a** dors. & r. lat. **b** post. **c** pal. **d** r. lat.: 4 photos Annot. see *Trans. zool. Soc. Lond.* **9** 1875 pl.35 f.1,5. *No. 46575 SYNTYPE

504 **a,e** † *Notornis* [*Porphyrio*] *mantelli* [*mantelli*] mounted skel. frontal & l. lat.: 2 photos **b,f** † *Aptornis otidiformis* mounted skel. l. lat. & frontal: 2 photos **c** † *Aptornis* [*defossor*] tympanic bone, 3 views: 3 s.d. J. Dinkel del. P: *l.c.* **7** 1871 pl.41 f.2,3,4 **d** † *Aptornis defossor** sk. r. lat.: prelim. p. sketch R.O. del. see *l.c.* pl.40 f.1 *No. 46498 Annot. SYNTYPE

505 **a1,2** *Aquila* [*Uroaëtus*] *audax* terminal phalanges of foot: 6 d. Annot. **a1A,2,3A,4** *Circus assimilis* **b** † [*Harpagornis moorei*] **A&B** femur, distal & proximal articulating surfaces **C** part of pelvis. 3 d. **c1** † *Harpagornis moorei** *No. 48056 Cast of HOLOTYPE **c2** † *Polyoaetes* [*Polyharpagornis*] *leucogaster* **c3** *Circus assimilis* l. femur of each, post. **c1–3** 1 c. & 2 outline d. **a–b** All c. d. Annot. **c1** Original spec.. Fig. *Trans. N.Z. Inst.* **4** 1872 pl.10 – HOLOTYPE

506 † *Dromornis australis** **a,d** r. femur, frontal & lat.: 2 photos, lithographs by J. Erxleben P: *Trans. zool. Soc. Lond.* **8** 1874 pl.62,63. Cast *No. 43960 A.M.S. No. F 10950 HOLOTYPE **b,c** sacrum, 3 views: 3 photos. Annot. *No. 49160

507 *Struthio camelus* **a** sk. r. lat. to show elements: 1 c.d. **b** sacrum, l. lat.: 1 p.d. R.O. del. **c** disarticulated sk.: 1 p.d. P: Owen, R. *Anat. of Vertebrates* Lond. 1866 **2** p.43 **d** head & neck of ♀, r. lat.: 1 c.d. Annot. **e** hyoid bones: 1 p.d. **f** head & neck of ♂, fronto-lat.: 1 c.d. Annot.

508 **a,b** ? † *Aepyornis* mounted claws, r. lat.: 2 photos. Annot.

509 **a** [*Struthio*] pelvis & caudal vertebrae of newly hatched specimen, vent.: 1 p.d. R.O. del. **b** [*Corvus*] pelvis & caudal vertebrae of embryo rook: 1 p.d. R.O. del. P: *Phil. Trans. R. Soc.* **153** 1863 pl.3 f.5,6

510 **a** [† *Archaeopteryx*, *Falco*, † *Pterodactylus*] leg & foot bones, lat.: 5 p.d. R.O. del. P: *l.c.* pl.3 f.1,3,4 **b** species as **a**, wing bones, lat.: 4 p.d. R.O. del. parts P: *l.c.* pl.2 f.1–4

511 **a** † *Odontopteryx toliapicus* [*toliapica*]* parts of sk.: 8 outline p.d. R.O. del. **b** proof plates of **a** C. L. Griesbach lith. P: *Q. Jl geol. Soc. Lond.* **29** 1873 pl.16 HOLOTYPE *No. 44096

512 **a** † *Didus solitarius* 'Hooded Dodo' [*Raphus cucullatus*] l. lat.: 1 engr. Annot. **b** † [*Raphus cucullatus*] head, l. lat. of Ashmolean Mus. specimen: 1 w.d. W.C. del. P: Strickland, H. E. & Melville, A. G. *The Dodo* Lond. 1848 pl.5 f.2. Annot. **c,d** *Pezophaps solitaria* skels of ♂ & ♀ Cambridge Univ. specimens: l. lat.: 2 p.d. R.O. del.

513 **a** † [*Lithornis vulturinus*]* sacrum, lat. & dors.: 3 p. & w.d. P: Owen, R. *Hist. Brit. fossil Mammals & Birds* Lond. 1846 p.553. *No. 38933 **b** *Casuarius galeatus* [*casuarius*] mounted skel. r. lat.: 1 photo. **ca** † *Didus* [*Pezophaps solitaria*] **cb** Solitaire [? *P. solitaria*] **cc** † *Pezophaps* [*Raphus cucullatus*] femurs: 1 photo. by Farren **d** † *Didus solitarius* [*Pezophaps solitaria*] mounted skel. r. lat.: 1 photo. by L. Berenger Annot.

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514 [*Pelecanus*] sternum, leg & foot bones: 25 i. & wash d. R. Bezold del. Annot.

515 [*Pelecanus*] cranium, upper & lower m., scapulae, coracoid, clavicle & wing bones: 42 i. & wash d. R. Bezold del. Annot.

516 **a** [*Pelecanus*] cervical vertebrae: 2 w.d. G.S. del. ? Orig. d. for *Trans. zool. Soc. Lond.* **5** 1840 pl.44 f.3 **b left** [*Crocodylus*] cervical vertebra: 1 engr. **b centre** *Aptenodytes patagonica* cervical & dors. vertebrae: 1 p.d. **b right** dors. vertebrae: 3 w.d. All [J. Dinkel del.] All P: *Phil. Trans. R. Soc.* **141** 1851 pl.52 f.52,48–51

517 **a** [Coraciiformes – Kingfisher – unident.] foot: 1 p.d. P: Owen, R. *Anat. of Vertebrates* Lond. 1866 **2** p.11 **b** [Caprimulgiformes – ? Nightjar – unident.] foot; 1 p.d. Annot. **c** [*Colymbus* [*Gavia*]] pelvis & hind limb skel. l. lat.: 1 p.d. Annot. P: *l.c.* p.78 **d** [*Struthio*] young skull, dors.: 1 p.d. Annot. P: *l.c.* p.51 **e** [Psittaciformes – Parrot – unident.] sk. r. lat.: 1 p.d. Annot. P: *l.c.* p.51 **f** [*Numida*] beak & eye, l. lat.: 1 p.d. P: *l.c.* p.10 **g** [*Calyptorhynchus*] sk. r. lat.: 1 p. & w.d. Annot. P: Owen, R. *On the Archetype . . . of the vertebrate skel.* Lond. 1848 pl.1 f.1 **h** [Psittaciformes – unident.] sk. showing elements, l. lat.: 1 p.d. L. A. del. Annot **i** [*Dromaieus* [*Dromaius*]] sk. showing elements, r. lat.: 1 p.i. & wash d. Annot. P: Owen, R. *Anat. of Vertebrates* Lond. 1866 **2** p.52 **j** [*Struthio*] sl. showing elements, vent.: 1 p.d. Annot. P: *l.c.* p.44 **k** † [*Halcyornis toliapicus*]* cranium, dors. lat. post.: 3 p.d. P: Owen, R. *Hist. Brit. fossil mammals & birds.* Lond. 1846 f.234 A & B, 235. HOLOTYPE *No. A 130 **l** 3 crania **l A,B** †[*Halcyornis toliapicus*]* dors. & post. HOLOTYPE *A 130 **l C** [*Larus*] dors. **l DE,** [Coraciiformes, Kingfisher, unident.] dors. & post. 1 lithograph (5 f.) P: *l.c.* f.234 **m** [*Numenius*] head & foot, l. lat.: 2 p.d. Annot. P: *l.c.* p.9 **n** [*Struthio*] foot, l. lat.: 1 p.d. P: *l.c.* p.13 **o** [Passerine, unident.] foot, l. lat.: 1 p.d. P: *l.c.* p.10 **p** [Piciformes, Woodpecker, unident.] foot, l. lat.: 1 p.d. P: *l.c.* p.11 **m–p** 4 p.d.

518 **a** [*Columba*] embryo, 8th day of incubation: 1 w.d. R.O. del. **b** [? Aves – unident.] postero-vent. diss. to show musculature: 5 c.d. Annot. **c** *Ardea argala* [*Leptoptilus dubius*] foot tendons: 1 p. sketch **d** [*Aquila*] brain lat. ventricles, ant. commisure: 1 w.d. **e** *Rallus aquaticus* urino-genital system & section of l. side of pelvis: 1 p. & 1 w.d. J. Erxleben del. Annot **f** [*Ramphastos*] tail muscles: 2 p. sketches **g** [*Anas*] diss. urino-genital system of ♀: 2 c.d. Annot.

519 **a** [*Dacelo* [*Lacedo*] *pulchella*] living specimen on branch, r. lat. & bill, dors.: 2 p.d. W. Taylor del. P: Horsfield, T. *Zool. Res. in Java* Lond. 1821 coloured pl. p.419 in B.M.(N.H.) copy **b1,b2** [Aves – unident.] 2 heads with necks diss.: 2 p.d. **c** *Vultur leucocephalus* [*Neophron percnopterus*] head, r. lat.: 1 w.d. Annot. **d** *Vultur* [*Neophron*] *percnopterus percnopterus* frontal: 1 p.d. Annot. **e** [*Apus*] head, l. lat. showing distended pouch: 1 s.d. J. D. C. S. del.

520 [*Gallus* domestic] with spur growing from head **a** l. lat. **b** head of same: 2 c.d. W. H. Clift del. Annot.

521 **a** *Delphinus delphis* dors. vertebrae 1–11, l. lat.: 1 s.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.48 f.16 **b** *Delphinus* [*Orcaella*] *brevirostris* sk. l. lat.: 1 p.i. & wash d. **c** ? *Grampus* [*griseus*] or *Pseudorca* tooth: 1 wash d. Annot. **d** *Delphinus* [*Orcaella*] *brevirostris* sk. parts numbered, lat.: 1 i. outline d. ? original sketch for P: *Trans. zool. Soc. Lond.* **6** 1866 pl.9 f.3 **e** *Delphinus tursio* [*Tursiops truncatus*] 5 dors. vertebrae, dors.: 1 s.d. P: *Phil. Trans. R. Soc.* **141** 1851 pl.48 f.15

522 † Megathere [*Megatherium*] articulated skel. l. lat.: i. & w.d. mounted on board for exhibition at B.M.(N.H.) Annot. P: Edwards, W. N. *Guide to an exhibition illust. early hist. of palaeontology* *Special guide No. 8. 1931

523 † *Diprotodon australis* skel. l. lat.: 1 p. & i. outline d. [R.O. del.] ? original for P: *Phil. Trans. R. Soc.* **160** 1870 pl.50

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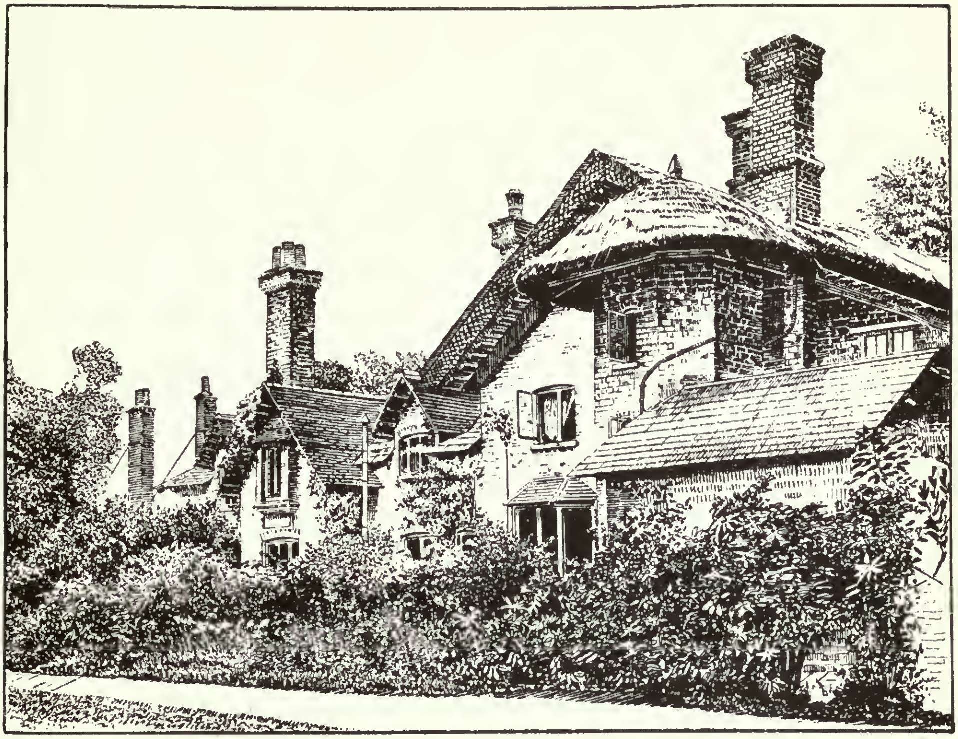
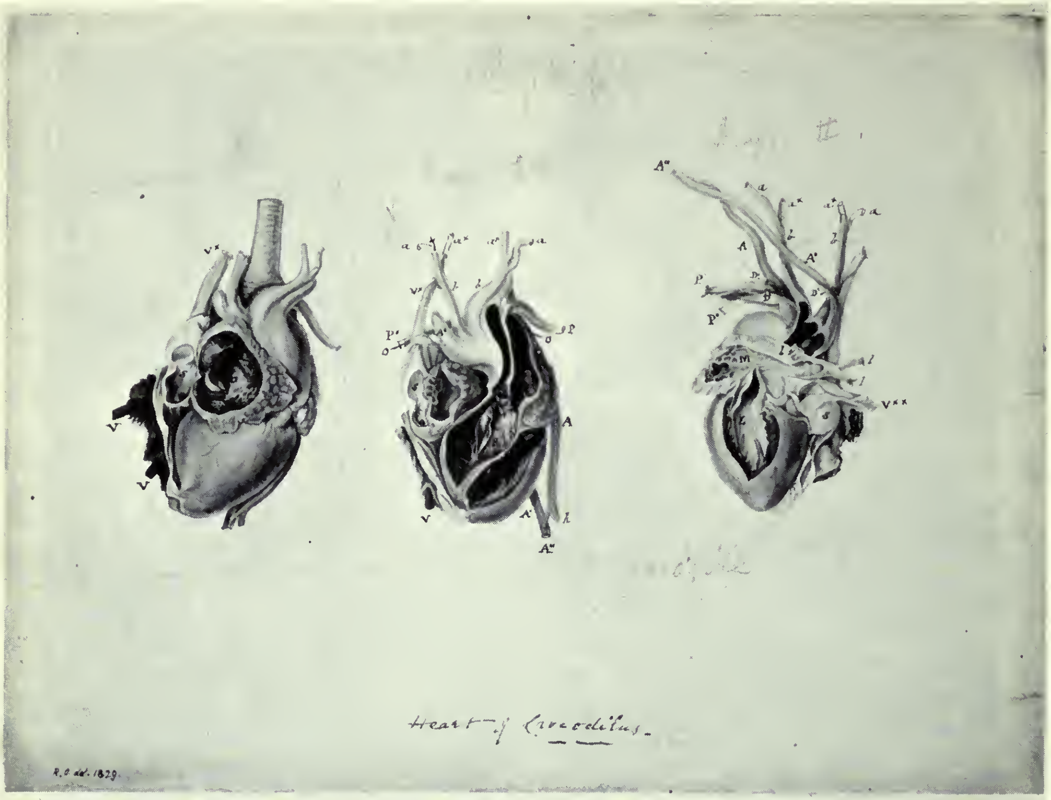
Some of Owen's medals preserved in the Museum.



Sheen Lodge, Richmond Park, Owen's home from 1852–1892. Rear view taken from the garden beyond the park wall.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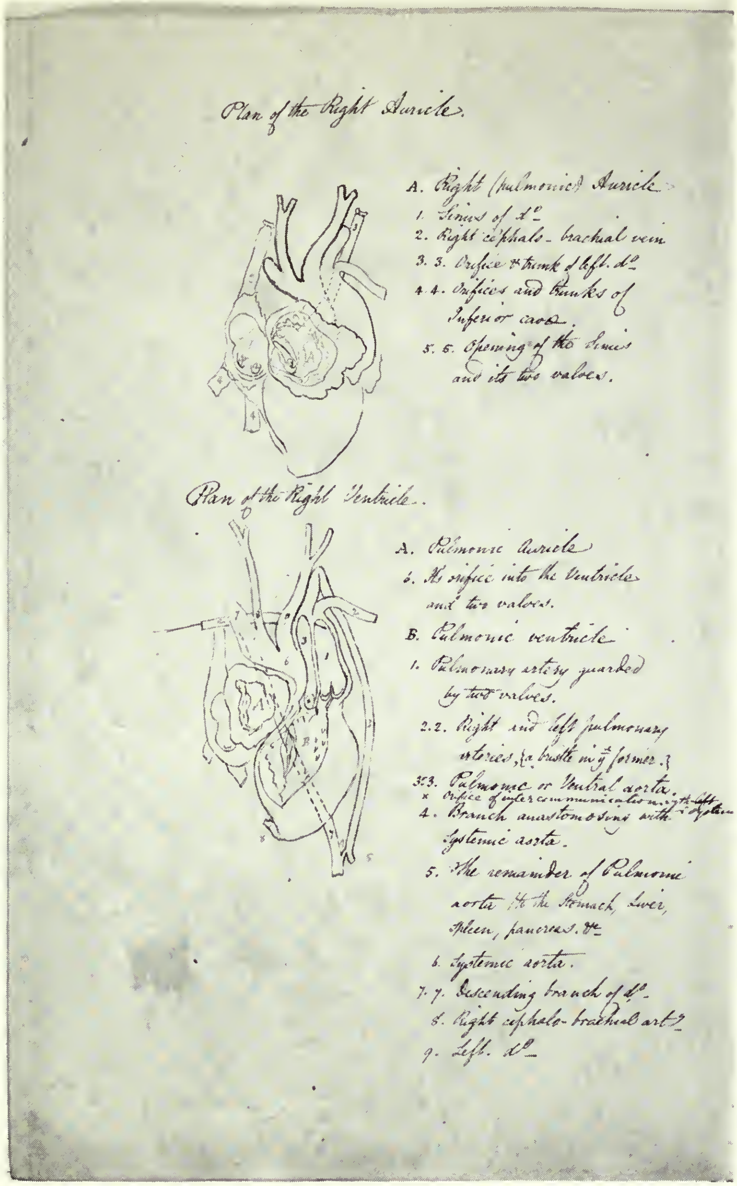
Heart of Crocodilus.
R.O. del. 1829.

Crocodile heart dissected and delicately illustrated in pencil and water colour by Richard Owen in 1829. Folio 192.



Plan of the Right Auricle.

A. Right (pulmonic) Auricle
1. Sinus of D°
2. Right cephalo-brachial vein
3. 3. Orifice & trunk of left. D°
4. 4. Orifices and trunks of Inferior cava.
5. 5. Opening of the Sinus and its two valves.

Plan of the Right Ventricle.

A. Pulmonic Auricle
6. Its orifice into the Ventricle and two valves.
B. Pulmonic ventricle
1. Pulmonary artery guarded by two valves.
2.2. Right and left pulmonary arteries, {a bristle in ye former.}
3.3. Pulmonic or Ventral aorta.
× Orifice of intercommunication with the left systemic
4. Branch anastomosing with the Systemic aorta.
5. The remainder of Pulmonic aorta to the Stomach, Liver, Spleen, pancreas. &c
6. Systemic aorta.
7. 7. Descending branch of D°
8. Right cephalo-brachial art.y
9. Left. D°

Some of the manuscript notes and drawings made by Owen in ink and associated on Folio 192 with the water colour illustrations opposite.

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The miscellaneous autobiographical manuscripts of John Edward Gray (1800–1875)

A. E. Gunther

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The miscellaneous autobiographical manuscripts of John Edward Gray (1800–1875)

A. E. Gunther K
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Introduction

Of the considerable volume of writings by John Edward Gray, for fifty years an official of the British Museum and for thirty-five its Keeper of Zoology, the autobiographical manuscripts comprise the most important source material for an understanding of his character and for seeing what sustained the impetus in his work. They form an essential complement to his scientific and

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historical output for which he himself had compiled a *List of Books, Memoirs and Miscellaneous Papers* (Gray, 1875) and in which nearly eleven hundred separate titles are given.

The corpus of Gray's autobiographical manuscripts may be divided, for convenience, into two classes. Into the first fall the more formal passages written, as it is believed, in response to requests. One of the longer of these appeared in final form in *Portraits of Men of Eminence in Literature, Science and Art* (Reeve, 1863; Gunther, 1974 : 72–76), contributed for his friend Lovell Reeve (1814–1865), the publisher and conchologist. The preparation for this seems to have taken the form of an *Autobiographical Journal* (Gray, *c.* 1862), followed by two or three drafts, but these suffer from the constraints usual in an author writing about himself for publication.

The second category, which gives the title to this paper, comprises a large quantity of miscellaneous manuscripts housed in the General Library of the British Museum (Natural History) (Gray, *c.* 1862–74). The manuscripts vary in length from a pensée of a few words to a dozen folios of the blue-grey half foolscap sheets that Gray was in the habit of using in the 1860s for his zoological work. About half of them are written in his own hand, the balance being dictated to his assistants; whoever wrote them there is no perceptible change of style and a correction or pagination in Gray's left hand implies his agreement to the text.

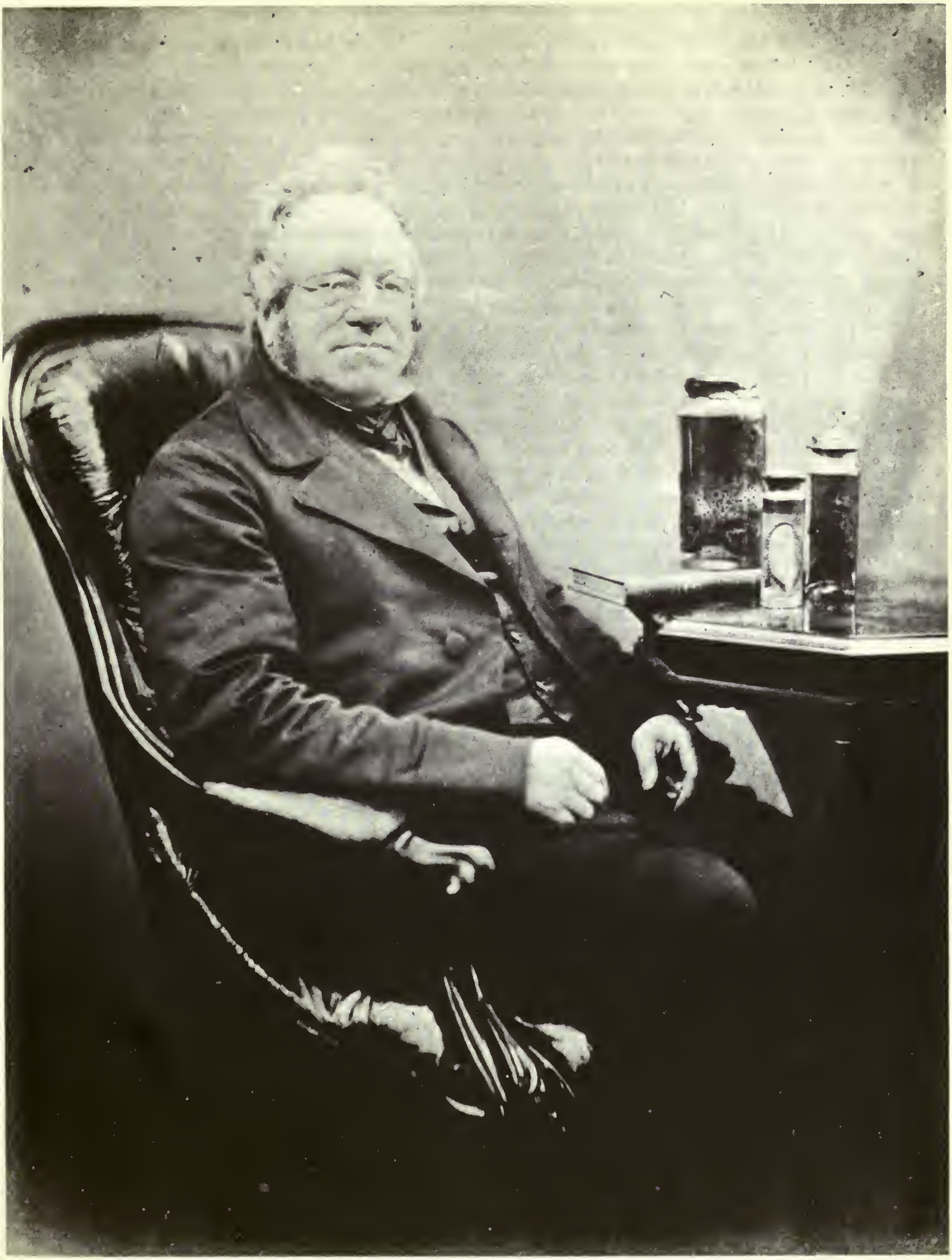
The dating of most of these fragments is open to conjecture. It is assumed that they were written in the decade between the publication of Reeve's *Men of Eminence* in 1863 and the last months of 1874. For Gray it was a decade of intermittent illness of increasing severity and he probably turned to jotting personal reminiscences during periods of incapacity, which may account for much of the repetition (like the claim relating to Penny Postage which seems to have worried him). Some of the later fragments can be dated because they were dictated either to E. A. Smith (1847–1916), appointed to the Museum in 1867 for the mollusca and lower animals, or to E. J. Miers (1851–1930), appointed in 1872 for the crustaceans, and purposely to serve as an amanuensis. More precisely dated is almost the last of the fragments disputing Francis Galton's (1822–1911) conclusions in *English Men of Science* (Galton, 1874), which loses nothing of its force coming from an aged invalid suffering periodic loss of powers.

Why these manuscripts came to survive is uncertain. Some were evidently available to the writers of the obituaries. The majority came into the hands of B. B. Woodward (1853–1930) who, as Librarian at the British Museum (Natural History) between 1881 and 1920, assembled them into an album bearing the title *Gray, J. E. Miscellaneous Papers* (Gray, *c.* 1862–74) preserved in the Museum's General Library. A number were also found among Albert Günther's papers in 1965, when the present writer was engaged on an account of Günther's life (Gunther, 1975) and these were added to Woodward's album. The most important item of all, the *Autobiographical Journal* (Gray, *c.* 1862), must have remained with the family, since it was presented to the Museum in 1970 by Gray's collateral descendant, Professor Peter Gray (b. 1908), then at the University of Pittsburgh.

Although a biographer cannot regret the circumstances that deflected Gray from continuing to multiply the immense number of his scientific papers, it is a pity that he gave so little background to his life and times, and even less to the memories his parents must have bequeathed to him of the eighteenth century. And why does he say so little about his mother? Self-centred as he was, it is also strange that a man as conscious as he was of his place among the naturalists of the day should have neglected to date the events he describes.

The manuscripts do, however, show clearly what were the principal influences in Gray's life, what gave it impetus, and what were the aims he set out to achieve. To understand them it is necessary to go back to the years of childhood in Chelsea (Gunther, 1975 : 1–20), and to the relations between Samuel Frederick Gray (1766–1828) and his two sons, Forfeit (1798–1872) the elder, and John Edward. It was fortunate for the lives of both John and his father that there was clearly a marked harmony of temperament between them. Also that John had the intellect to respond to his father's interests, so that in the early house-bound years of John's invalidism, his father's influence took root.

Between Forfeit and his father there was evidently no such rapport; and the influence of the elder brother worked as a subconscious challenge to the younger and brought out his combativeness. While Forfeit went off to school, which the parents could not afford for two boys anyway,



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John Edward Gray, c. 1868. From a photograph in an album of the Literary and Scientific Portrait Club, edited by James S. Bowerbank, in the Linnean Society of London Library. (On table: Lindley, J. 1849. *Economical Botany*; jars (left) Neotropical anuran, (centre) Sea mouse, (right) unclear.)

or to play with his friends, John sat in an invalid's chair having to content himself with the *Encyclopaedia Britannica*; every meal time must have left a sense of deprivation from the food he could not stomach; and the realization of his greater intelligence would increase his determination to do what Forfeit refused to. When later his brother demurred at taking over a night watch in a bookstore in which his father had an interest, it was John who went in his place; and it was John who took over as assistant in the Wapping pharmacy when Forfeit left for the Apothecaries' Company. Therefore, if we are to seek in John's life for the source of combativeness and the need to justify himself, we can look to the deprivations of childhood and the influence they wrought on his character. Conscious as a young man of his intellectual powers, his early failure to secure election to the Linnean Society (Reeve, 1863 : 114) and later, opposition within the Museum or neglect by the academic world, must have brought back all the sublimated frustrations of childhood, and redoubled the determination to succeed.

The conflict between father and elder son is reflected in Forfeit's life, from his failure to make anything of the Apothecaries job, or even taking its licentiate, to his failure in a partnership as 'S. F. Gray, Chymist and Drugist' which landed him in the debtors' prison. It says much for John's charity in later years that he seems to have put several jobs in his brother's way, like the trip to the continent (Gunther, 1977) with J. G. Children (1777–1851), the Keeper of the British Museum's natural history collections where John was working. We may suppose that John drew his brother, as an apiarist, on to the Juror's Panels at the Great Exhibition of 1851 and again in 1860 and encouraged his contributions to the *Gardener's Chronicle* (Anon., 1872 : 430). Who else was there to pay for his brother's release from prison? John, on the other hand, was constantly working with his father; as a student taking over his father's lectures, collecting receipts from Mr Willat's drugstore in the City as material for his father's *Pharmacopeia* (Gray, S. F. 1818), or collaborating on the *Natural Arrangement* (Gray, S. F. 1821). During long intervals of illness and frustration, Samuel Frederick perhaps found solace in what John was contributing towards his unfinished work. Weakness of health prevented steady application. Politically a radical non-conformist, he was cold shouldered, or felt himself to be, by the naturalists of the day; his important botanical work was rejected, others making capital, scientific and financial, out of his scientific publications; and there was the culminating failure of his elder son, Forfeit.

If John inherited his intellectual potential from his father, the pattern of its expression may have come from his mother, of whom little is known. If his mother's father, as a picture dealer in Maiden Lane, Covent Garden (Gray, *c*. 1862: f. 3), ran a successful business, John's acumen and organizing ability could have come from that side. That he was endowed with a quick and versatile brain capable, before illness dulled it, of grasping the essence of any problem, scientific, social, financial or other, is abundantly clear. It was a mind that had been prematurely developed under conditions of childhood delicacy, in a confined home life and a precocity stimulated by his father, a man of exceptional intellect. Adolescence found Gray a student in advance of his years and one his elders found responsive. If the portrait of him at the age of 19 is any guide (1), and his looks in later life seem to confirm this, his was an attractive personality.

His father's social circle of radical intelligensia provided a stimulus that became John Edward's nature, and he thrived in an environment of naturalists (Gray, *c*. 1862 : f. 12). The first of his friends was William Salisbury (d. 1823), the botanist, a family friend from Chelsea days, who invited Gray to attend his lectures at the Maze Pond medical school, which he was later to take over. The next of his friends, with whom he went on his botanical rambles from Wapping (Gray, *c*. 1862 : f. 27), was the entomologist James Francis Stephens (1792–1852), who introduced him to William Elford Leach (1790–1836), then assistant to the Keeper of the natural history collections at Montagu House (Reeve, 1863 : 114). Of all those whom Gray was to meet in his professional life, Leach's influence was the greatest. Ten years older than Gray, he was to assume the role of the inspiring tutor to the promising pupil; he was to wean Gray from botany to zoology and to give him a future he could not have realized in medicine.

At that time, Leach was contributing to the outstanding Supplement of the *Encyclopaedia Britannica*, issued in six volumes between 1815 and 1828. Its aim was to make good the omissions and defects of the 4th to 6th editions (1810, 1815 and 1823), and to bring the arts and sciences up to date. It was the first edition of the *Encyclopaedia* to name its authors. Although Leach was among the eminent naturalists on the list of contributors, it is not certain which articles he was asked to do, since the only one completed by him, before illness overcame him, is that on the *Annulosa* (signed 'V'), the others on *Conchology* and *Mollusca* being taken over by the Rev. Dr Fleming, D.D., F.R.S. (1785–1857) and signed 'QQ'.

Leach's inspiration meant much to a young man of Gray's inclinations at that period of his life: to have contact with a brilliant, original mind; to be given the run of the collections at Montagu House, and to be introduced into Sir Joseph Banks' library, was encouragement indeed (Reeve, 1863 : 114).

The influence of the men he met at the Museum was at a professional rather than at a personal level, since Gray at 18/19 years of age was already developing maturity through original work. Apart from lecturing on botany at the medical schools he was helping his father with the *Natural Arrangement*. At Banks' residence, 32 Soho Square, he consorted with distinguished academics, among them the French savants, H. M. D. de Blainville (1777–1850) and M. F. Dunal (1789–1856), and the most eminent of all, Baron Georges Cuvier (1769–1832); he also met the Swiss, A. P. de Candolle (1806–1893), and he made friends with the troublesome Richard A. Salisbury (1761–1829) and especially with John Richardson (1787–1865).

From 1822, after John George Children succeeded Leach, who had resigned through illness (Gunther, 1974 : 65), to 1824, when Gray was formally appointed in the Museum, he had developed under Children's supervision into a fully qualified assistant. Children's influence was of quite a different order from Leach's. Whatever his academic ability, which was considerable, his was the role of a man old enough to be Gray's father, which was what Gray most needed after his unsettling years as a medical student and his decision that medicine held no place for him. At any rate, the security of employment the Museum offered made marriage possible and from 1826 Gray's anxieties for the future came to an end.

The text of the fragments assembled in this paper, arranged as far as possible in chronological order, has been left unaltered except for some punctuation, spelling and paragraphing. Repeated versions of the same event have been omitted. But versions differing from those already printed elsewhere have been included, either because they complete the story or because they give it a different shade of meaning. Since the fragments do not offer a narrative in sequence, I have added notes to carry the reader through. The notes do not, however, repeat the fuller account of Gray's life published elsewhere (Gunther, 1975), but they include information not available at the time the published text of the *Autobiographical Journal* was prepared. Also included are various letters because they contain important additional information about the policy Gray was following in museum affairs.

There remains some problem about the dating of events in Gray's earlier years unless more information comes to light. From 1835, however, the House of Commons Select Committee of 1835–1836 (Parliamentary Papers, 1836) brought some system into the affairs of the Department of Natural History and led to the keeping of a series of letter books which bear the title of *Reports, Minutes etc. Zoological Department* (British Museum 1835–1853) which, assembled by Gray himself, give a detailed record of his Keepership. Therefore after about 1835 the dating of events referred to in his autobiographical manuscripts can generally be verified. These records also show the extent to which the then Keeper, J. G. Children, depended on Gray for the detailed running of the department (2). In addition to these records there are the Trustees Annual Reports of the Department of Natural History printed as part of the *Accounts Relating to Income and Expenditure, and Number of Persons Admitted* to the Museum (Parliamentary Papers, 1848–1868).

Miscellaneous autobiographical manuscripts

Note: the folio numbers in the left hand margin refer to *J. E. Gray, Miscellaneous Papers* (Gray, *c.* 1862–1874) in the British Museum (Natural History), General Library.

Samuel Gray IV (1694–1766) seedsman of Pall Mall

(f. 57) My great grandfather (3) had an estate at Oundle in Northamptonshire. In the Churchyard there you may read, or could fifty years ago, that the Grays were not particular as to how they spelt their name. Thus one of [the] Grays fathers was spelt Wray, and a Wray had a father called Ouray, according to their tombstones. My father who had a great estimation for and studied Natural History in the books of the justly celebrated John Wray of Black Notley who spelt his name Johannes Rayius in his latin works which has been retranslated John Ray, thought that he was possibly a branch of the same family, but I have not attempted to unravel the question. (4)

Samuel Gray V (1735–1771) seedsman of Pall Mall

(f. 49) My grandfather, Samuel Gray, (3) was a seedsman at the Black Boy, Pall Mall, and had a garden in Tettlefields, Westminster, and was much in the habit of going there on Sunday afternoon. The house was pulled down when they built Carlton House. (5) His father and grandfather, also Samuels, lived there before him. They had much intercourse in the way of trade with Holland & they imported the making of flour of mustard and the cutting of glass from that country. Before they introduced it the mustard seed was crushed as it was required in a wooden bowl with a wooden [or] iron ball. They had a mill on the Ravensbourne (6) just at the back of Deptford, for the grinding of the mustard and the cutting of the glass. The mill is now known by the name Armoury Mill. The cutting of the glass was afterwards carried on as a separate business by their younger brother, who had a shop near Charing Cross. (7)

I recollect in my childhood my father inherited a massive glass candlestick, which was a specimen of the work done at the Mill. The flour of mustard was extensively used and I may cite as an instance of the length of time during which trifles may exist that when at Fishguard in Pembrokeshire (8) a few years ago I observed on the wall (f. 50) behind the door of the general shop of that small village a Bill about 4 inches square pasted up, with "Sold Here Grays' flour of Mustard only to be had at the *Black Boy, Pall Mall*", and with the figure of the Nigger. Now that shop must have been closed for more than a century. The old woman in the shop said she knew nothing about it but that she recollected it was there when she was a child.

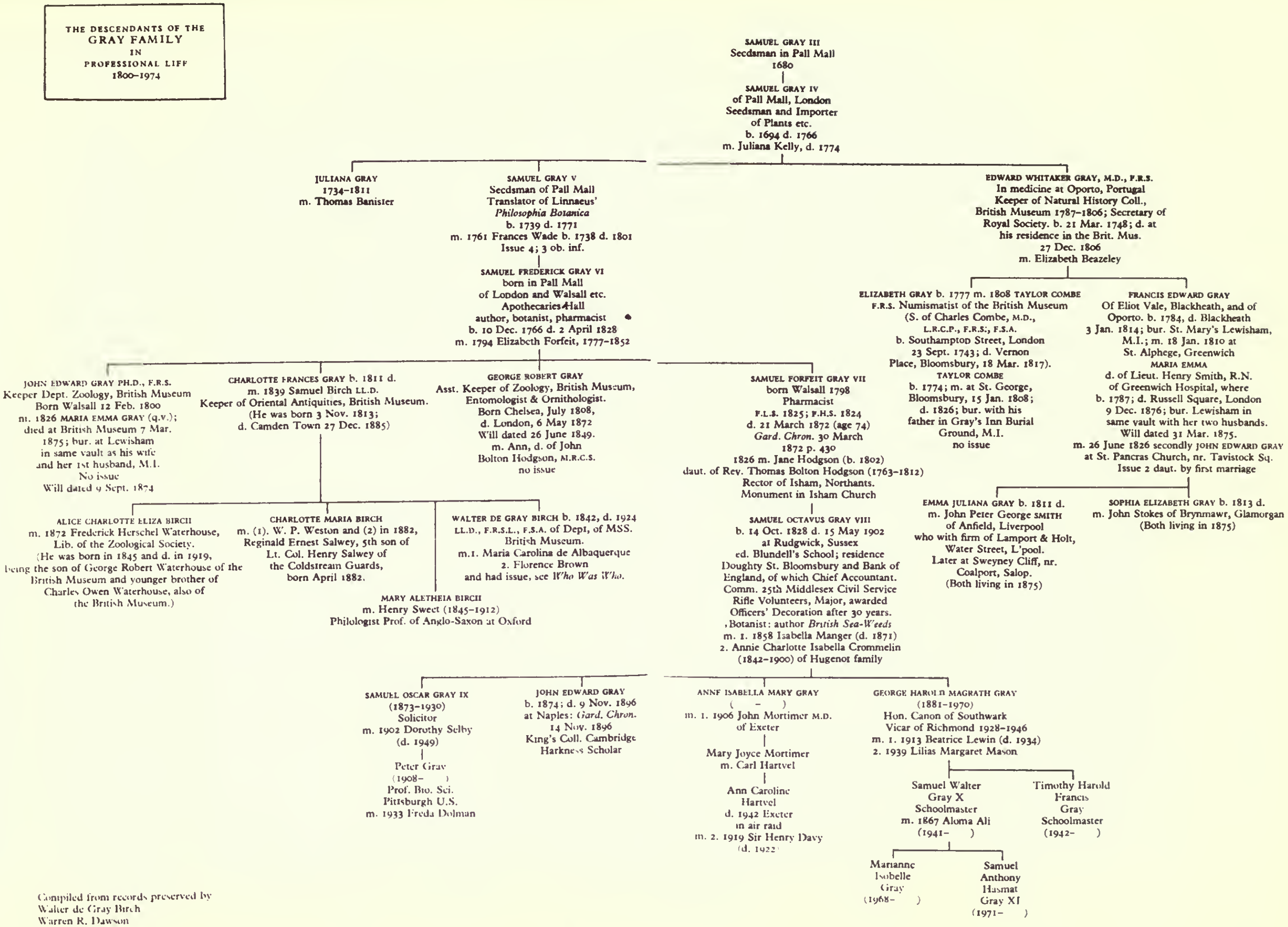
This woman showed a curious want of knowledge too well known to the poor in large towns. I had already purchased a boot lace and she could not change me a shilling so I emptied my purse for a smaller coin and turned out a farthing that I always keep at the fold to prevent the ring coming off. She took it up, and said "Is that what you call a farthing? I had been told you had such things in London but I never believed it", and she offered to take it for the penny lace. She was anxious to possess it and show it to her friends. She was more astonished when I told her that there were half farthings and I had several of them, but that the shop keepers were very adverse to using them, and that even smaller copper coins were made at the Mint and much used in Malta and other British possessions.

Edward Whitaker Gray, M.D. (1748–1806)

E. W. Gray, John Edward's great-uncle, was an important influence on his life, and this fragment summarizes most of what John knew about him, further discussed in Gunther (1976).

(f. 53) Edward Whitaker Gray M.D.

The eldest [younger] son of Samuel Gray (3) of Pall Mall was born the 21 of March 1748. He was educated in London, studying medicine under Dr. William Hunter (9). He practiced medicine in Oporto (10) and on his return to this country with a collection of Natural Productions of that country, he was appointed, chiefly by the interest of Dr. William Hunter, Assistant Librarian having charge of the Natural History Collections in the British Museum in 1778. On the 11 Feb 1779 he was elected Fellow of the Royal Society. In 1787 he was promoted to be Keeper of the Natural History Collections and Secretary to the British Museum and on the 30 of Nov. 1797 was elected the senior first secretary to the Royal Society. He retained these three offices until his death on the 27 of December 1806 (11); he was succeeded secretary of the


THE DESCENDANTS OF THE GRAY FAMILY IN PROFESSIONAL LIFE 1800–1974
SAMUEL GRAY III Seedsman in Pall Mall 1680
SAMUEL GRAY IV of Pall Mall, London Seedsman and Importer of Plants etc. b. 1694 d. 1766 m. Juliana Kelly, d. 1774
JULIANA GRAY 1734–1811 m. Thomas Banister
SAMUEL GRAY V Seedsman of Pall Mall Translator of Linnaeus' *Philosophia Botanica* b. 1739 d. 1771 m. 1761 Frances Wade b. 1738 d. 1801 Issue 4; 3 ob. inf.
SAMUEL FREDERICK GRAY VI born in Pall Mall of London and Walsall etc. Apothecaries Hall author, botanist, pharmacist b. 10 Dec. 1766 d. 2 April 1828 m. 1794 Elizabeth Forfeit, 1777–1852
EDWARD WHITAKER GRAY, M.D., F.R.S. In medicine at Oporto, Portugal Keeper of Natural History Coll., British Museum 1787–1806; Secretary of Royal Society. b. 21 Mar. 1748; d. at his residence in the Brit. Mus. 27 Dec. 1806 m. Elizabeth Beazeley
ELIZABETH GRAY b. 1777 m. 1808 TAYLOR COMBE F.R.S. Numismatist of the British Museum (S. of Charles Combe, M.D., L.R.C.P., F.R.S., F.S.A. b. Southampton Street, London 23 Sept. 1743; d. Vernon Place, Bloomsbury, 18 Mar. 1817).
TAYLOR COMBE b. 1774; m. at St. George, Bloomsbury, 15 Jan. 1808; d. 1826; bur. with his father in Gray's Inn Burial Ground, M.I. no issue
FRANCIS EDWARD GRAY Of Eliot Vale, Blackheath, and of Oporto. b. 1784, d. Blackheath 3 Jan. 1814; bur. St. Mary's Lewisham, M.I.; m. 18 Jan. 1810 at St. Alphege, Greenwich
MARIA EMMA d. of Lieut. Henry Smith, R.N. of Greenwich Hospital, where b. 1787; d. Russell Square, London 9 Dec. 1876; bur. Lewisham in same vault with her two husbands. Will dated 31 Mar. 1875. m. 26 June 1826 secondly JOHN EDWARD GRAY at St. Pancras Church, nr. Tavistock Sq. Issue 2 daut. by first marriage
EMMA JULIANA GRAY b. 1811 d. m. John Peter George SMITH of Anfield, Liverpool who with firm of Lamport & Holt, Water Street, L'pool. Later at Sweyney Cliff, nr. Coalport, Salop. (Both living in 1875)
SOPHIA ELIZABETH GRAY b. 1813 d. m. John Stokes of Brynmawr, Glamorgan (Both living in 1875)
JOHN EDWARD GRAY PH.D., F.R.S. Keeper Dept. Zoology, British Museum Born Walsall 12 Feb. 1800 m. 1826 MARIA EMMA GRAY (q.v.); died at British Museum 7 Mar. 1875; bur. at Lewisham in same vault as his wife and her 1st husband, M.I. No issue Will dated 9 Sept. 1874
CHARLOTTE FRANCES GRAY b. 1811 d. m. 1839 Samuel Birch LL.D. Keeper of Oriental Antiquities, British Museum. (He was born 3 Nov. 1813; d. Camden Town 27 Dec. 1885)
GEORGE ROBERT GRAY Asst. Keeper of Zoology, British Museum, Entomologist & Ornithologist. Born Chelsea, July 1808, d. London, 6 May 1872 Will dated 26 June 1849. m. Ann, d. of John Bolton Hodgson, M.R.C.S. no issue
SAMUEL FORFEIT GRAY VII born Walsall 1798 Pharmacist F.L.S. 1825; F.H.S. 1824 d. 21 March 1872 (age 74) *Gard. Chron.* 30 March 1872 p. 430 1826 m. Jane Hodgson (b. 1802) daut. of Rev. Thomas Bolton Hodgson (1763–1812) Rector of Isham, Northants. Monument in Isham Church
ALICE CHARLOTTE ELIZA BIRCH m. 1872 Frederick Herschel Waterhouse, Lib. of the Zoological Society. (He was born in 1845 and d. in 1919, being the son of George Robert Waterhouse of the British Museum and younger brother of Charles Owen Waterhouse, also of the British Museum.)
CHARLOTTE MARIA BIRCH m. (1). W. P. Weston and (2) in 1882, Reginald Ernest Salwey, 5th son of Lt. Col. Henry Salwey of the Coldstream Guards, born April 1882.
WALTER DE GRAY BIRCH b. 1842, d. 1924 LL.D., F.R.S.L., F.S.A. of Dept. of MSS. British Museum. m.1. Maria Carolina de Albaquerque 2. Florence Brown and had issue, see *Who Was Who.*
MARY ALETHEIA BIRCH m. Henry Sweet (1845–1912) Philologist Prof. of Anglo-Saxon at Oxford
SAMUEL OCTAVUS GRAY VIII b. 14 Oct. 1828 d. 15 May 1902 at Rudgwick, Sussex ed. Blundell's School; residence Doughty St. Bloomsbury and Bank of England, of which Chief Accountant. Comm. 25th Middlesex Civil Service Rifle Volunteers, Major, awarded Officers' Decoration after 30 years. Botanist: author *British Sea-Weeds* m. 1. 1858 Isabella Manger (d. 1871) 2. Annie Charlotte Isabella Crommelin (1842–1900) of Hugenot family
SAMUEL OSCAR GRAY IX (1873–1930) Solicitor m. 1902 Dorothy Selby (d. 1949)
Peter Gray (1908–) Prof. Bio. Sci. Pittsburgh U.S. m. 1933 Freda Dolman
JOHN EDWARD GRAY b. 1874; d. 9 Nov. 1896 at Naples: *Gard. Chron.* 14 Nov. 1896 King's Coll. Cambridge Harkness Scholar
ANNE ISABELLA MARY GRAY (–) m. 1. 1906 John Mortimer M.D. of Exeter
Mary Joyce Mortimer m. Carl Hartvel
Ann Caroline Hartvel d. 1942 Exeter in air raid m. 2. 1919 Sir Henry Davy (d. 1922)
GEORGE HAROLD MAGRATH GRAY (1881–1970) Hon. Canon of Southwark Vicar of Richmond 1928–1946 m. 1. 1913 Beatrice Lewin (d. 1934) 2. 1939 Lilias Margaret Mason
Samuel Walter Gray X Schoolmaster m. 1867 Aloma Ali (1941–)
Timothy Harold Francis Gray Schoolmaster (1942–)
Marianne Isobelle Gray (1968–)
Samuel Anthony Hasmat Gray XI (1971–)

Compiled from records preserved by
Walter de Gray Birch
Warren R. Dawson
George H. M. Gray
Samuel Walter Gray

The descendants of the Gray family in professional life 1800–1974. Reproduced from A. E. Gunther, *A century of zoology at the British Museum, 1815–1914* (London: Dawson, 1975).

Royal Society by Sir Humphrey Davy. He published two [three] papers in the *Philosophical Transactions* entitled . . . (12) He married in Oporto, Miss Bearsley, and had four children (13); one of the daughters married Mr. Taylor Combe the first Keeper of the Antiquarian Department in the British Museum and for some years Secretary of the Royal Society from 1812 to 1824; the other died single.

Samuel Frederick Gray (1766–1828)

(f. 51) My grandfather had several children but they all died at a very early age and he left only a small life annuity to his wife and the rest of his property to his younger brother Dr. Edward Whitaker Gray, then in Portugal, but afterwards Keeper of the Natural curiosities in the British Museum and Secretary to the Royal Society.

(f. 54) A month or so after his [my grandfather's] death, his wife bore him a son [10 December 1766] who was christened Samuel Frederick Gray (14). As he lived, he was a very sickly child and he was dumb, but his mother, a woman of great energy devoted herself to him; she taught him to read and to ask for all that he required by means of letters cut out from bills and pasted on cards, so that he could read quite well when he could speak. Eventually he gathered strength and by the time he was ten [or twelve] years old he outgrew the defect in the organs of speech and gradually learned to speak but to the end of his life he had a very considerable impediment. His mother taught him Latin and Greek as well as English, devoting the whole of her time to his instruction and care, and he was of a very studious disposition. He was attached to old fashioned ways for I have heard it stated that he was almost the last man in London that wore his hair (that was very long and when untied would reach to his knees) in a large club and cocked hat.

(f. 51, 54) He was not regularly educated to any profession but that of medicine and anatomy, [and] selected various branches of Natural History and Chemistry, and what is now called Ethnology. He seems to have taken to editing as a means of livelihood, and for several years assisted Dr. Nairs [sic] (15) as sub-editor of the *British Critic*. But the misfortune of his birth seems to have followed him, for about this time he fell in love with a Miss Forfeit (16) and consulted his uncle [Edward Whitaker Gray] with the purpose of marrying, but the uncle, having come to the conclusion he should have no children . . . [was prepared to disown him]. (17)

On his marriage to Elizabeth Forfeit in 1794, he migrated to Walsall and then to Birmingham where he turned his knowledge of Chemistry to account, assisted by Dr. Priestley (18) and established an Assay office. Here a daughter and his two sons were born. In 1800 he returned to London, became private accountant to Charles Hatchett Esq. F.R.S. (19) and continued his literary occupations, contributing to various reviews and periodicals as far as his declining health would allow. (f. 56) In 1818 he published the *Supplement to the Pharmacopeia* [Gray, S. F. 1818] which ran through several editions and is now published by Redwoods [1847].

He died on 12 April 1828 and is buried in New Chelsea Church Yard – bearing three sons and two daughters. Two of his sons, John Edward and George Robert (20) are employed in the British Museum and his younger daughter is married to Mr. S. Birch (21) of the same establishment.

John Edward Gray (1800–1875)

Born at Walsall, his family moved to Old Chelsea in 1800, remaining there until 1811 or 1812. Like his father the boy was extremely delicate, probably suffering from a childish form of tuberculosis, and remained so until about 10 years of age.

Chelsea 1800–1811 or 1812

(f. 6) Being a sickly child, and a friend having lent me the volumes of the *Encyclopaedia Britannica*, I read them and made models of the plates of the dials, other mathematical inventions, and formed the idea of becoming a Mathematical Instrument maker or a Millwright.

Mr. Charles Hatchett (19), when calling on my father observed some card models, dials and an electrical machine that I had made out of an old bottle and offered that I should come and live in his house at Hammersmith and assist in his laboratory. My father after consideration thought I was too young and declined it for me. Mr. Hatchett soon afterwards took Mr. Brand. (22)

(f. 59) The first time I left home in 1811 I went to Mr. Wyatt (23), a bookseller in Pickett Street, Strand, with whom my father had an idea of entering into a partnership. I went on a Saturday and found only a room behind the shop furnished. Mr. Wyatt lived in the neighbourhood of London and I was left the only inhabitant of the large unfurnished house from Saturday night to Monday morning and every other night. I well recollect the quarter of an hour chimes of St. Clements Church my only companion, but my continuance there was not of long duration, as my father found that the partnership was not desirable.

Apothecary at Wapping, 1812–1816

In 1812 or 1813 the Grays moved to Wapping, a mile down the Thames from the Tower of London, and Frederick Samuel set up as Surgeon and Apothecary, remaining until about 1816. These three years transformed John Edward into a very capable young man and student.

(f. 6) My father . . . purchased the business of Mr. Pratt, the chemist and druggist in High Street, Wapping, (24) with the intention of settling my elder brother, but very shortly after we were established there, Mr. Symonds, the president of the Apothecaries Company offered my elder brother an appointment in that Institution which he accepted leaving my father who was in very ill health in a great difficulty, as he had just invested his money in the business, and I saw no other way out of it, than doing what I could to occupy the place that he had intended for my elder brother, giving up my predilection for a more scientific occupation though I had much repugnance to anatomy and the other duties necessary for the study of the medical profession. But I overcame the repugnance.

(f. 58) Of course in a nautical district like Wapping we had many surgical cases, and employed a young surgeon as an assistant and I often had to attend to the cases, especially on board the ships, and I had some opportunities of seeing difficult mechanical and other processes by the kindness of the persons with whom I became acquainted more especially the elder Rennie (25) who was then engaged at the London Dock.

(f. 110) As a boy on hearing the cry that the press-gang was coming – a cry that soon cleared the streets of Wapping where I was residing – I went to the shop door and seeing a man running who wanted shelter, I beckoned him into the shop, and told him how he could pass into another street through our back door. I had hardly told him so before the officer and his men arrived at the shop door, knocked me down, cut me across the hand with his sword, the scars of which I still bear, and as I failed to find the man in the house, they took me off, and kept me prisoner on board the tender off the Tower for some 24 hours.

This and the going aboard a vessel to dress a very severe scald that a man had on board a ship, when the river was filled with ice and one could only go aboard by passing from hummock to hummock on a hurdle made me a kind of hero in the estimation of the workmen in the neighbourhood.

Botanical studies

While at Wapping, as assistant in his father's shop, John Edward continued to study botany by week-end excursions south of the Thames into what was then country-side and villages. The peace, following the Battle of Waterloo, brought depression of trade to the ports on the Thames.

(f. 63) I was in the habit of taking long walks in the neighbourhood of London when the shop was closed on Saturday night returning to be ready on Monday morning, often sleeping part of the night on the lee side of a hedge or haystack to be ready to catch the insects at early dawn and I believe that the establishment of my health may be dated from this exercise. It was on one of these excursions that I became acquainted with Mr. J. F. Stephens (26).

(f. 61) On my father being obliged to retire from the business in High Street, Wapping, by the stagnation of business in that district by the peace and from ill health, I became an assistant in the laboratory of Mr. Willat, wholesale chemist and druggist, in Fore Street, Cripplegate. While there I copied after the warehouse was closed all the receipt books I could obtain the loan of from the different chemists and druggists; the greater part of these receipts were classified and printed by my father in the "*Supplement to the Pharmacopeias*" (Gray, S. F. 1818).

Sequence of events, 1816–1824

In 1816 the Grays moved from Wapping to Hatton Garden, in the City, and John's medical education started from there. He was invited to attend a school of Anatomy and Surgery run by John Colley Taunton (d. 1858) also in Hatton Garden; and to attend the lectures William Salisbury (d. 1823), botanist friend of the Grays in their Chelsea days, at the Maze Pond school near the Borough Hospitals of St Thomas and Guy's south of London Bridge. His attachment to St Bartholomew's Hospital under Dr John Abernethy (1764–1831) and to the City Dispensary were of a more formal character, and may have followed a year later.

The dating of events in Gray's life between the failure of the Wapping pharmacy and his appointment at Montagu House in 1824, remains uncertain, but the following is suggested:

1816 Gray family leave Wapping for Hatton Garden. John Edward invited to attend Taunton's School and William Salisbury's lectures at Maze Pond. Probably first met W. E. Leach and invited to Montagu House.

1817 Formal attachment at St Bartholomew's Hospital under Abernethy; takes over Salisbury's lectures at Maze Pond, and assists W. E. Leach at Montagu House.

1818 Routine medical education continues to 1823. Working with his father on *A Natural Arrangement* . . . (Gray, S. F. 1821) and given access to Sir Joseph Banks' library; assisting Leach at Montagu House; giving botanical lectures at Maze Pond, St Bartholomew's and Middlesex Hospitals.

1820 Leach's illness takes hold; Gray acting as assistant; *A Natural Arrangement* . . . completed.

1821 Gray visits Walsall on 21st birthday (7th February) and makes tour of Midlands, Manchester, Liverpool, etc. (Or perhaps between April and November 1823.) At Liverpool probably meets William Rathbone (1787–1868) educationalist and philanthropist, Mayor in 1737 (*D.N.B.*, **47** 1896 : 310); Joseph Brooks Yates (1780–1855) merchant and antiquary (*D.N.B.*, **63** 1900 : 298); and a member of the Holt family, unidentified, of later shipping interest (Gunther, 1974 : 65). George Samouelle appointed at Montagu House; *A Natural Arrangement* . . . published ; J. G. Children takes Leach's place and moves into Museum apartment on 9 December.

1822 Children formally appointed 9 March. Gray meets Children at Montagu House and is invited to help with the collections; he spent two or three half days a week doing so. Is rejected by Linnean Society on 16 April.

1823 2 April: receives Certificate of Attendance as Surgeon from C. J. Cusack, Royal College of Surgeons, and decides to give up medicine. From November 1823 to May 1824 Gray engaged in editing *Mechanics Weekly Journal*.

1824 Is appointed by Admiralty as naturalist on H.M.S. *Blossom*, and immediately resigns. 24 December, offered employment at Montagu House at 15/- each working day.

Medical education, 1816–1823

(f. 62) After leaving Mr. Willat I commenced medical studies as a pupil of Mr. Abernethy at St. Bartholomew's Hospital, of Dr. Merriman (27), of Middlesex Hospital and of the private schools of Mr. Taunton in Hatton Gardens and of Mr. Grangers' (28) of Maze Pond, giving lectures on Botany at the two latter and attending the practice of Dr. Unwins (29), Mr. Taunton and Mr. Kingdom (30) at the City Dispensary . . .

(f. 6) But I must say I always felt that medicine could do little and that the larger part of the patients required better food and solace, and [I] saw clearly that I should never make more than my livelihood by the practice of medicine.

(f. 7) While occupied in the study of medicine I was in the habit of going out from Saturday night till Monday morning into the country taking long walks and collecting plants and insects which I used to study and then give away to other collectors with whom I became acquainted. These had a great influence on my future life.

While a child living at Chelsea I knew William Salisbury (31), the partner of William Curtis, and author of the *Flora Londoniensis* (32). When a medical student he invited me to attend his lectures on botany at Grangers' School of Medicine in Maze Pond, and excursions to collect plants. He entered into a speculation of forming a botanic garden in Sloane Street, failed and was imprisoned for debt in the middle of one of (f. 60–62) his courses. [In 1817, in result], I was elected by my fellow pupils, all much my senior (one of them being William Clift jr., son of Mr. Clift (33)) [of the College of Surgeons], to continue the lectures and conduct the excursions, which I did for succeeding years.

Sir Joseph Banks' library

(f. 7) In these I became acquainted with Mr. Stephens (26) and Dr. Leach (34). The latter introduced me to Sir Joseph Banks (35) who kindly gave me permission to attend his breakfasts and made whatever use I could of his Library and Collections. In this Library I became acquainted with R. A. Salisbury (36) and other English botanists and with Mr. de Candolle (37), Dunal (38) and other foreign botanists. With the advice of those named I prepared the paper on the Progress of Botany in the year 1820 that appears in *Thompson's Annals* (39), and wrote the systematic part of the *Natural Arrangement of British Plants* (40) which introduced the Natural System of Plants to English readers, and gave great offense to the majority of English scientific men as being an attempt to upset the Linnean System which was then universal and which it certainly has done, for now the Natural System is as generally accepted as the Linnean System formerly was.

(f. 57) My father regarded Jussieu's '*Genera Plantarum*' (41) as a natural extension caused by the progress of science of Wray's '*Methodus Plantarum*' and believed that the progress of Botany was retarded by the adoption in this country of the Linnean artificial system which, by the way, was not carried through, but its author acknowledged several natural groups as *Didynamia*, *Syngenesia* etc. Fortunately we have never had [in zoology] a system based on numbers or any other artificial grouping of zoology.

(f. 64) While studying at the Banksian Library, Mr. R. A. Salisbury (36) offered to settle on me his property at his death if I would undertake to print his botanical MSS. which I declined. The same offer was made to Lindley (42) who was a student in the Library at the same time. The property and MSS. were at length left to Mr. William Burchell (43), the African traveller, who has just died at an advanced age without publishing anything of Mr. Salisbury's. Miss Burchell, who was going to burn the MSS. etc., at my solicitation gave them to me, but unfortunately they were in a very deranged state.

(f. 65) I printed one portion of them that appeared to be in a nearly finished state and I gave the large number of dissections of genera of plants which were most beautifully drawn in pencil by Mr. Salisbury, after I had mounted them, in 4 thick guard books to the Botanical Department, British Museum. The *Lyriogame* and the genera *Pyrola* and *Ercine* in the Natural arrangement of plants are the only part of his MSS. that have been printed. (44)

Rejection by the Linnean Society, 1822

(f. 8) Shortly after the publication of the *Nàtural Arrangement*, Mr. Haworth (45), R. A. Salisbury (36), Mr. Vigors (46) and some of the active naturalists invited me to become a Fellow of the Linnean Society and they signed my certificate. However without any notice given to them, or me, on the night of the election, a large number of Fellows were assembled by special invitation and I was rejected nearly unanimously. Only one of the recommenders were present, as they considered my election a matter of course, and no candidate had been before rejected. If the slightest hint had been given me, I should immediately have withdrawn my name, as the subscription to the Society was more that I could well bear. The rejection only had the effect of making me more determined to devote myself to Science. Many members retained their opposition to the end of their lives. The President (47) found it necessary to alter his *Grammar of Botany* [1821] to the Natural System and it was gradually coming more and more into use. One President, the Bishop of Norwich, invited me to the Anniversary Dinner, and proposed my health (48). The Council referred a paper to me to report on and I was asked to subscribe to the bust of Sir James E. Smith. At length I was solicited to become a Fellow of the Society and was unanimously elected and have served on the Councils etc.

Spare time at Montagu House

The introduction Gray had been given by J. F. Stephens to Dr Leach allowed him to spend such spare time as he had from his medical studies, in Montagu House, and led him to hope that he might secure a niche there, but this was not immediately realized.

(f. 63) Dr. William E. Leach, who then had the care of the Zoological Collection at the British Museum, greeted with his usual enthusiasm a young man who had some knowledge of the works of Cuvier, Lamarck and Latreille (49), works which Dr. Leach was translating, and bringing for the first time before the English student, a work that he chiefly did at night, and eventually destroyed his health.

(f. 7) I gave as much of my leisure as was at my disposal . . . to assisting Dr. Leach in the naming and arranging of the Museum Collection. Dr. Leach, with his unceasing desire to introduce the improvement in zoology which the French had made and the translation of their works which appeared in the *Encyclopaedia Britannica* and the *Edinburgh Encyclopaedia* (50), overworked his brain and was forced to take rest and eventually retire. I offered myself to the Trustees to keep the Collection in order, in the hopes that with rest he might recover. But my predilections for the Natural System had raised many enemies against me, and they used their influence to prevent my obtaining it, and recommended the appointment of a person who proved to be inefficient.

(f. 70) I was a candidate some years previously, to be employed in the Museum to look after the Natural History Collection during Dr. Leach's (34) illness. Mr. König (51) promised me his support and recommendation and desired me to keep my candidature private. I did not succeed. Mr. König in his evidence before the Committee (52) states that he recommended that Mr. Samuel [Samouelle] (53) be employed. It appears that Mr. Alexander MacLeay (54) invited Mr. König to breakfast to meet Mr. Samuel (f. 71) and the affair was then arranged. Mr. Samuel was a porter at Messrs Longmans, fond of collecting insects but quite ignorant of the scientific part of the subject . . . He compiled an introduction to Entomology chiefly extracted from Dr. Leach's (50) translations of Latrielle's *Considerations* in the *Edinburgh Encyclopaedia* (55). He knew so little of the subject that he left out the sections into which the families were divided, so that the genera were quite incomprehensible and the book useless to the student.

. . . he once said to me "that you should not work so hard as your work will come to an end before you did to yourself". He took to drinking and was discharged by the trustees. Mr. König was very charitable and gave him a sovereign when he came to beg of him; he went direct to the public house and drank away his money and suddenly died on his way home.

(f. 7) While working with Leach (34) I had paid particular attention to Shells and afterwards [following the Samouelle incident] Mr. James Sowerby (56) the elder proposed that I should continue the study, and that he and I should publish work on the subject together, he drawing the plates, and I writing the text, [but Mr. Sowerby was taken ill and died the following year.]

(f. 66) Being disappointed in 1821 in obtaining the temporary care of the Zoological Collection of the British Museum during the ill health of Dr. Leach (34), I turned my knowledge of mechanics and chemistry to account, became one of the Editors of the *Mechanics Weekly Journal* (57), and made a two months excursion through the midland and northern and western district of England, to examine the manufactures and factories, and to obtain a personal knowledge of the wants and feelings of the working people of those districts, and during this visit I made the acquaintance of several of the leading commercial notabilities especially the Rathbones, the Yates and Holt, who remained my friends to the end of their lives. [In part 1823? See dating above.]

(f. 19) It was my day dream when a lad that I should like to be like my great uncle, the Keeper of the Natural History department in the British Museum, most improbable considering the circumstances of my father and myself caused by his continued ill-health. But somehow from a child I had found many celebrated men who were kind to
(f. 67) me . . . And whereby I have been enabled under the fostering kindness of Dr. Leach (34) and Mr. Children (58) to spend a great part of my leisure in arranging the Collection, to obtain regular employment which had been the chief object of my ambition for several years.

Keepership of J. G. Children, 1822

(f. 10) Mr. Children, who was appointed to succeed Dr. Leach, and having occasion in the course of my studies of Shells to visit the Museum Collection [in 1822] to examine some genera that I had not seen elsewhere, Mr. Children observed that I seemed to have a good knowledge of Shells and asked me to look over the Collection that was being arranged and eventually asked me if I would be willing to give him what assistance I could. On his invitation, I attended constantly at the Museum, affording him gratuitous assistance, he little thinking of the difficulties that I had to support myself.

In spite of Gray's poverty at the time, he appears to have had no wish to work elsewhere than in the Museum.

(f. 10) It was decided that Captain Beechey's Expedition should be accompanied by a naturalist (59). On Mr. Children and Captain Sabine (60) speaking to me, if I was willing to undertake the office, they recommended me to the Admiralty for the appointment which was duly made on most liberal terms. I soon found from Captain Beechey's manner that I should not be able to do much and that what I did was to be done in the Captain's Cabin and written in his Journal. For as he said "he was not going to have his expedition named the Gray Expedition as Captain Bandini's Expedition was called the Expedition of Peron and Le Sueur" (61), whereon I resigned my appointment and on going to tell Mr. Children what I had done he said he was put under great difficulties by my absence, and asked me if I would accept a situation in the Museum to assist him. I said it was the hopes of getting such a situation on my return that had made me accept the situation on the Expedition and I should be glad to assist him, as I had made up my mind to devote myself to the study of Zoology. (f. 19) He ex-
(f. 19) pressed great astonishment when I accidentally mentioned the very great straits that I was under during the time that I had worked at the Museum without any pay.

(f. 10) On consulting with the Principal Librarian (62) it was agreed between him and Mr.

John Edward Gray, 1830, by Henry Phillips. Reproduced by courtesy of the Director, Royal Botanic Gardens, Kew.

Children, to recommend me, and I was appointed by the Trustees to be engaged for
six months at 15 shillings a day on the days actually employed in making out a Cata-
(f. 20) logue of the Reptiles. I was appointed in 1824 for six months, but as I told the Trustees
several years ago [in the 1860s] the term had not come to an end yet.

(f. 20) Mr. Children kindly consulted me and most frequently adopted the suggestions I made to him. I set out with the desire: 1st to make the Zoological Collection as perfect as possible, 2nd to allow the public and the student to have the utmost freedom in consulting and studying the collection consistent with its proper preservation.

Select Committee, 1836

(f. 10) When the Parliamentary Enquiry (63) [Parliamentary Papers, 1836] into the British Museum took place, I assisted Mr. Children in compiling statistical accounts of the state of the Collection, and it was upon his recommendation, though only temporarily appointed and receiving daily pay, I was called as a witness as to the state of the Collection, and to answer the objections that had been given in evidence against its extent, condition and management. Mr. Hawes (64) repeatedly asked me if I had no personal grievance, for he had observed that a personal grievance seemed uppermost in the head of all the officers during their examination. I told him I had none, and that if I had, I did not conceive a Parliamentary Committee the right place to ventilate it, and that I understood the Committee was to examine the present state, management of the Museum, and to recommend how it could be rendered more efficient. I freely gave my opinions on these questions and the Committee in their Report generally adopted my suggestions (65).

(f. 71) Mr. Samouel (66) and his friend Mr. Millard, an assistant discharged for his idleness, supplied to Mr. Hawes a number of stories against the different persons employed in the Museum. Mr. Hawes said, I have a great deal of information supplied to me but I suppose I am unfortunate in my choice for I cannot use it all, and when I asked a question from them I always meet with a distinct denial supported by good evidence.

(f. 69) . . . Mr. Children before the Parliamentary Committee on the Museum observed that he considered "the best thing that he had ever done for the Museum was the recommendation of Mr. Gray". When the evidence was published I had a note from Sir R. Inglis (67) observing, that the Editor of the Report [Sir H. Ellis] had rather modified Mr. Children's answer in the printed evidence, into "one" of the best things.

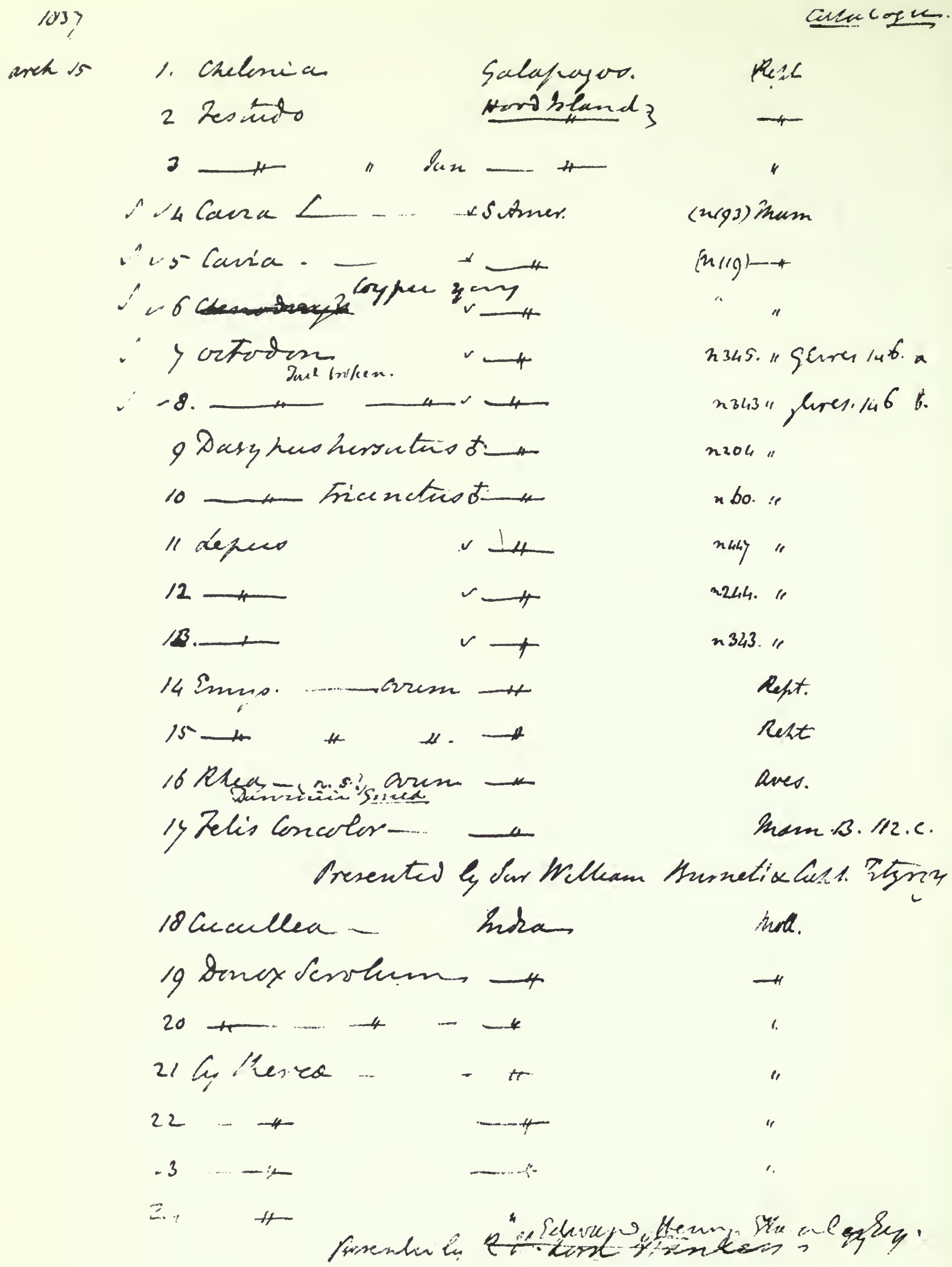
(f. 10) A few [four] years after the Committee, Mr. Children resigned the Keepership of the Zoological Dept. which had been separated from the Mineralogical and Botanical, and I was appointed to succeed him (68).

I have formed during the time that I have been employed by the Trustees, chiefly at a small annual expenditure, the largest and most complete and best arranged and named Zoological Collection in the world. I think I am justified in saying so when persons who study particular parts of Zoology come to study it, they always find the Collection of their part the largest and best arranged that they have consulted, and if each part is so, the whole must be. I have during that time prepared or edited the publication of 200 Catalogues of different parts of the Collection, and printed more than 1000 memoirs or essays on the specimens in the Collection several of them of considerable extent. [Gray, 1875]

Management of the Zoological collections

(f. 10) The general management of the business of the Department, the collecting and seeing after the preservation of the specimens has occupied the greater part of my time and constant supervision is required to keep the various persons employed and parts of the Collection in order.

(f. 75) Being convinced that the superintendence, preservation and extension of a collection, whether of Natural History, Books, Manuscripts, or Antiquities, was as much a



1837 Catalogue.

March 15 1. Chelonia Galapagos. Rept.

2 Testudo Hood Island "

3 " " Jan " "

4 Cavia " S. Amer. (n/93) Mam

5 Cavia " " (n119) "

6 ~~Chinchilla~~ Copper " " "

7 Octodon " n345. " Glires 146. a

Intl broken.

8. " " " n343 " Glires 146 b.

9 Dasypus hirsutus ♂ " n204 "

10 " tricinctus ♂ " n60 "

11 Lepus " n447 "

12 " " n244. "

13. " " n343. "

14 Emys. avium " Rept.

15 " " " " Rept

16 Rhea — n.s.? avium " Aves.

Darwinii Gould

17 Felis concolor " Mam. B. 112. c.

Presented by Sir William Burnett & Capt. Fitzroy

18 Cucullea India Moll.

19 Donax Scrobium " "

20 " " " "

21 Cytherea " "

22 " " "

23 " " "

24 "

Presented by ~~Rt. Hon. Lord Stanley~~ Edward Henry Stanley Esq.

Accessions Book of the Zoological Branch of the British Museum, first folio in the hand of J. E. Gray, 15 March 1837.

business as any other commercial occupation, and as such required a regular, special education, a person who is required to successfully carry on a business with a special knowledge of the subject added, I therefore strongly recommended that a number of young men should be appointed to learn the business and that those that showed an aptitude for their work should be promoted, instead of the usual easy system of promotion according to seniority which drives away all the younger men who feel that they have higher qualifications and leave only the second rate men who did just (f. 76) enough to keep their posts. Thus Assistants have left the Museum that are now leaders at the Bar, Colonial Judges and other holders of important offices, who saw that there was no chance for their talent under the usual system of seniority.

(f. 67) I always felt great interest in what I felt ought to be a School of Natural Science of the nation.

(f. 72) The chief cause in my success in founding the very large Zoological Collection has been the catholicism of my taste, having had no predilection for any series of animals but having desired to collect all that came in my way to store them away in their systematic places, with the history of each specimen attached to it so that they might be available for the student who might desire to study them, and the student has usually been astonished at the riches of the part of the collection which he has desired to study, and that he may use them in every way that is most desirable as if they were his own on the single condition that they should not be rendered less useful to any student that might come after him.

(f. 10) I think it is a great proof of the successful manner in which I have collected and arranged the different parts of the Collection that Walker (69), Smith (70) and other entomologists have published such extensive Catalogues of Insects, and Dr. Günther (71) Catalogues of Fishes, Snakes and Batrachians which he found here ready collected and roughly arranged, and only awaiting his descriptions.

Duplicates and exchange of specimens

As Gray's uncle, Edward Whitaker Gray, had found in the previous century, and as every keeper has found since, the disposal of duplicate specimens is more easily planned for than effected. The problem was that of accepting whole collections when only half the specimens were required. John Edward got round the problem through his interest in building up collections in the provincial towns; he would see that unwanted specimens did not formally come into the Museum at all, but went elsewhere. His successor, Albert Günther, also found that the problem of getting rid of duplicates gave his staff so much work that they passed it back to himself.

(f. 20) And I was soon convinced that the collection of duplicates was a great evil as they required as much care as the collection themselves and that it was best to purchase or select from those presented only specimens which were actually required for the collection, more especially as the exchange of specimens was very troublesome and led to much inconvenience, and was in fact returning to the habits of the ruder ages before the persons had found that it was better to buy and sell for money. I made it a rule to recommend that the specimens we did not require should be given by their proprietors to some other institutions or be sold so that those who required them could purchase them. I am sorry to say that my recommendations of specimens being given away have not always been so successful as I could wish; as the following details will show; but I do not regret having followed the plan, and certainly the selection of specimens we wanted has enabled me with the kind assistance of the Trustees to collect together the largest and most complete and easily consulted collection of Zoological specimens and osteological specimens in the World.

(f. 21) Several years ago, accidentally calling on an agent, he informed me he had just purchased from a person coming from Hudson's Bay a series of skins of a small Buffalo and that he intended to have them made into rugs or robes. I at once saw that they were the skins of the Mus[k] ox. Knowing that we had two specimens in the

Museum which were considered to be the only two known in Europe I purchased on my own account the whole series and presented a specimen to Paris, Leyden, Frankfurt, Stuttgart and one or two other towns. I know they were received but I never received any acknowledgement of their arrival except from Stuttgart. The King of Wurtemburg kindly sent to the ambassador a decoration of an order, but the ambassador at once informed him that I should not be allowed to wear it as a civilian and returned it without my knowledge on which he sent me a gold medal as one of "the Worthy". (72)

The Museum has very recently received (73) from Germany the offer of a skin of this animal asking me what price the Museum would give for it and letting me know that a very large price was expected. Now these animals are found on the coast of Greenland as well as in the barren parts of the arctic regions, they will probably become more usual in Museums. The German specimen was probably brought by their late scientific expedition.

(f. 22) Dr. Ruppell on the return from Abyssinia (74) where he travelled for the purpose of collecting, brought home with him a considerable number of Mammalia and birds for the Senckenberg Society of Frankfurt and for the purpose of enriching it by the exchange of his duplicate specimens which he had obtained. He sent a very perfect series of the Animals and birds to the British Museum. I told him that we had no specimens that we could offer in exchange for them but that if he would state a price or appoint a person to state a price I made no doubt that we should agree and that as he disliked to receive money for his specimens if he went about among the dealers in London or Paris and selected what he desired and sent the bills to me I would pay them to the amount which the collection of Abyssinian animals amounted to. After some objection he agreed to this proposal and made extensive purchases.

Being some years afterwards in Frankfurt I asked Dr. Ruppell how he had succeeded in the exchanges of his Abyssinian specimens; he said very badly and that the only place in which he had received a fair return of specimens was from the British Museum. Yet somehow the Continental and especially American Naturalists seem to be prejudiced in favour of the barbarous system of exchange in which in general each person seems to think that he has been over-reached.

(f. 23) The widow of Admiral Sir John Harvey (75) made an extensive collection of shells, sea-eggs and other animals which she took with her to Edinburgh. When she was removing from that City she consulted me what she had best do with her collection. As the Universities were talking of establishing a school of Natural History I recommended that it should be sent to Oxford. She communicated with the Authorities and they sent a man to pack it up and transmit it to Oxford. Nothing further was heard of the collection. Some years after meeting Mr. John Phillips at the British Association meeting at Cheltenham (76) I enquired of him what had become of the collection and what had been done with it. He declared that he knew of the existence of no such collection in the University and seemed to doubt its ever having been sent there. His sister was with him and observed, "Why John, it is one of the boxes in the collection that you found in the basement of the Taylorian Institution and did not know from whence it came." When I went to Oxford to see the new [University] Museum I identified many of the shells that came out of that box as being part of Lady Harvey's collection, but I suppose the birds and other things were destroyed by damp [and] insects.

Osteology

(f. 24) In 1846 Mr. B. H. Hodgson (77) who during his residence in Nepal collected a very large series of Mammalia and Birds and their skeletons and gave them to the Museum on condition that it should print a catalogue of them and distribute the series of duplicates of them according to their completeness to various British and Continental collectors. [As] The Catalogue observes, a series was selected from them for the

British Museum collection and the duplicates were distributed in series and sent to various British and Continental collections in the following order:—

1. Museum of the East India Company
2. Museum of the University of Leyden
3. Museum of the Garden of Plants, Paris
4. Museum of the University of Berlin
5. Museum of the Senckenbergen Society at Frankfurt
6. Museum of the University of Edinburgh
7. Museum of Trinity College, Dublin
8. Museum of the Natural History Society, Newcastle-on-Tyne
9. (f. 25) Museum of the Canterbury Natural History Society
10. Museum of the Manchester Natural History Society
11. Museum of the Earl of Derby, Knowsley
12. Museum of Hugh Strickland Esq. Oxford (78)
13. Museum of the Zoological Society.

The duplicates of the osteological specimens were sent to:–

1. Museum of the [Royal] College of Surgeons
2. Museum of the Royal Naval Hospital, Haslar.

Unfortunately many of the specimens [of the skins] had been in the country several years and from the want of being opened and examined they were not in very good condition. Perhaps this may explain why I have not observed a single specimen of any of the birds sent, exhibited in any of the Continental Museums which I have visited since that time.

(f. 26) The collection of osteological specimens was very important to the Museum as it was the first large collection of that kind that the Trustees had ever accepted and it may be considered the basis of the largest osteological collection in Europe that the Museum now contains (79). The collection sent to the College of Surgeons was found by Mr. Flower (80) many years afterwards in the box in which they were sent, in the basement of the College with all the labels rotted, without any indications from whence they came and Mr. Flower was able to identify them by comparison with the specimens in the Museum.

(f. 27) On Mr. Burchell's return (81) in the early part of this century [1815] he showed his collection of skins and mammals to Dr. Leach (34) and presented them to the British Museum. They were very interesting as being the first South African skins that we had in the country; but they were taken off the animals and the smaller ones instead of being rolled up and packed were lying about the waggon while the larger ones, as the giraffe, were stretched out on the outside of the cover of the waggon. The consequence was that the skin of the legs had very much shrunk and the hair on many parts of the body were destroyed so as to quite unfit it for stuffing. The skins of the male and female giraffe and of the zebras were stuffed at a very great expense and the Museum were quite as much abused for showing such bad specimens as it was for not having more stuffed by those who did not know their state.

(f. 28) Fortunately Major Hamilton Smith (82) examined and drew all the specimens when they first arrived; he had the habit of drawing animals as if studied from life whether he took it from a few fragments as the head, tail and limbs, from an important skin in a bad state or from a bad wood-cut or figure such as those in Piso & Margrave, [sic], (83) or from a worse sketch, so that his figures must not be taken as representing the state of the specimens when he saw them. I speak this from personal knowledge as I was often with him when he made the figures from Burchell's specimens and from other sources. Mr. Burchell was a peculiar person; he gave out that he was going abroad, but took a small lodging at Blackheath and there composed the first volume of the early part of his travels which only are published. (84)

> (f. 29) He kept the birds and other specimens he collected, had some of the birds stuffed and had all the specimens placed in boxes and carefully papered up. They remained in this state during his journeyings in Brazil (85). He was a very careful man and all his collections of animals, insects and plants were placed in order, in a large room, at the back of his house at Fulham. But being fond of drawing and music, especially the organ, he did very little in Natural History during the latter part of his life.
>
> When Dr. Ruppell (74) came to England after the Abyssinian Expedition (86) and was very anxious to see some of Mr. Burchell's birds, I took him to see my kind friend and after considerable hesitation he agreed to show him some of his African type (f. 30) specimens: but there was a difficulty about getting the boxes open. We went down a second time in a few days, provided with a hammer and chisel to prevent a recurrence of the same difficulty. Mr. Burchell laughed at our persistence and agreed to our opening the box containing the Vultures which was most carefully packed, but when opened it contained nothing but the naked skull, arm and leg bones, all the rest had been eaten up, and this was unfortunately the state of all the boxes of African birds which we examined much to our grief and disgust: for the remains showed that Burchell had collected in the early part of the century many species which were described for the first time by Dr. Ruppell half a century later. When Mr. Burchell died, the insects, skulls of animals and the zoological specimens collected and left by Mr. Burchell were given by his sister to the Museum at Oxford, and the dried plants etc. to Kew.

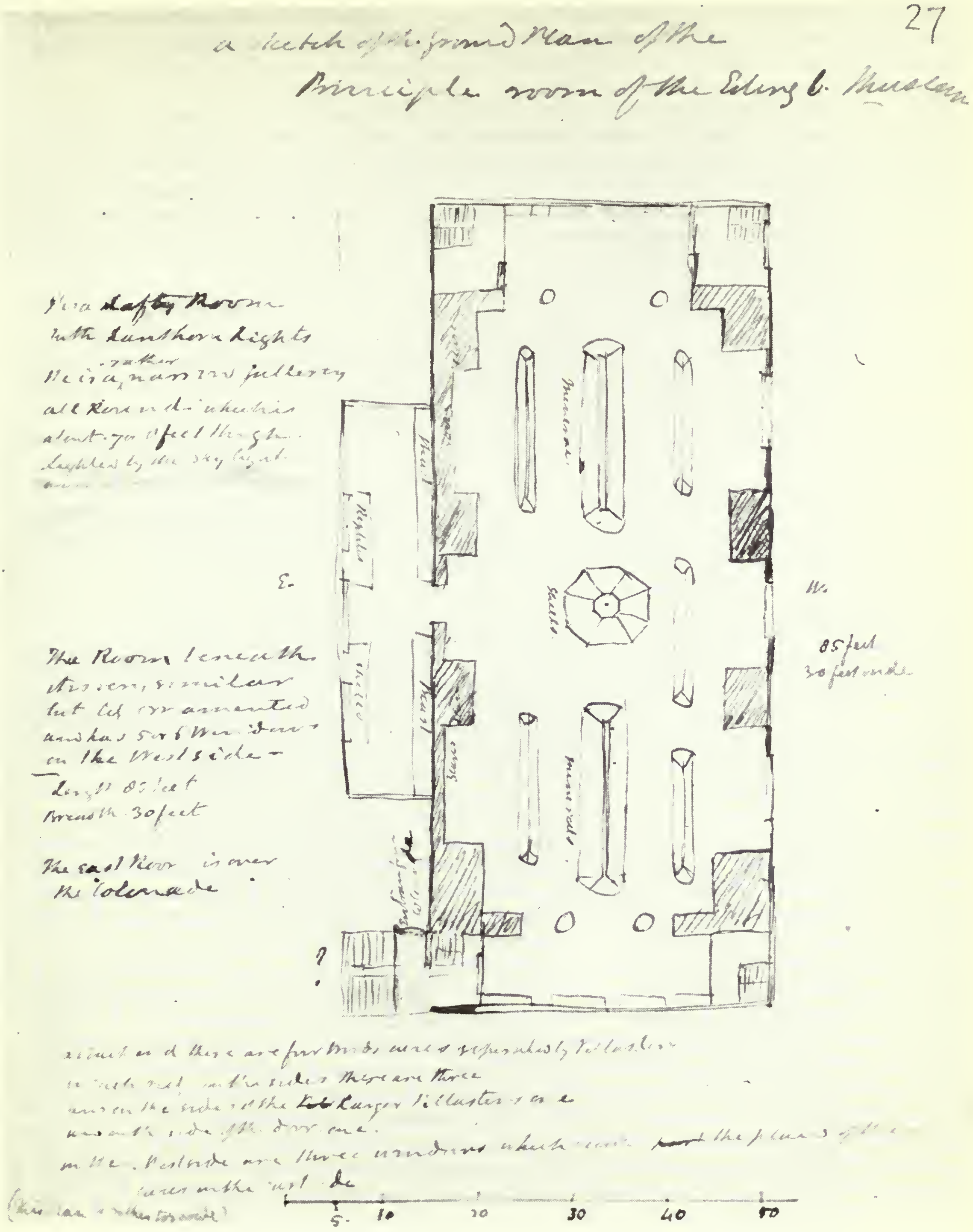
Provincial museums

Since accepting gifts of whole collections meant loading the Museum with duplicates it did not want, Gray went to great pains to deflect them elsewhere. It was a policy that ran counter to that accepted at Montagu House where duplicates crowded the basement for the enjoyment of moths and ptini.

> (f. 110) I have endeavoured to assist in the formation of Museums not only in the provinces and in Australia but in the Universities. (f. 73) It was on my recommendation that the late Lord Derby gave his collection to the town of Liverpool . . . (87) I also gave great assistance in procuring and sending Massena's Collection of Birds to Philadelphia (88), and especially in greatly extending the National Museum of Melbourne in Victoria (89) and the herbarium of Trinity College, Dublin (90), with a very large collection of plants of all countries formed in Belgium.
>
> (f. 110) At my recommendation Mrs. McCulloch [sic] sent her husband's very extensive Collection (which paid legacy duty as being worth a thousand pounds), of minerals and geological specimens to the University of Oxford; although we knew that the Collection arrived safe neither Mrs. McCulloch or I ever received thanks for the present. And I believe that the Collection is put away in some unknown place, for one cannot conceive that a Collection consisting of a number of very heavy cabinets of between 4 and 5 feet by 3, have vanished into thin air (91).
>
> More lately Mr. Robert MacAndrew, after a consultation with me, left his large Collection of Shells, and Natural History books to one of the Universities, [Cambridge] having in my own mind no predeliction for one over the other at his death, which has just occurred (92).
>
> I need not add that a self-taught man as I am I ever received the slightest recognition of my exertions in the cause of Science from either of the Universities.

Botanical Society of London, 1836

After the publication of *A Natural Arrangement* in 1821 and his rejection as Fellow by the Linnean Society in February 1822, Gray turned, under Leach's influence, from botany to zoology, although he probably continued botanical lecturing for his living. But he never lost his interest in botany and maintained contact with it through the Botanical Society of London (Gunther, 1975 : 74)



27

a sketch of the ground Plan of the
Principle room of the Edinb. Museum

It is a lofty Room
with Lanthorn lights
there is a rather narrow gallery
all round in which is
about 70 feet length
lighted by the sky light
[illegible]

The Room beneath this room, similar
but less ornamented
and has six Windows
on the West side —
Length 85 feet
Breadth 30 feet

The east Room is over
the Colonnade

at each end there are four birds cases separated by pilasters
on each side [illegible] on the sides there are three
ones on the sides of the ~~[illegible]~~ Larger pilasters one
on each side of the door one.
on the West side are three windows which [illegible] ~~[illegible]~~ the places of the
cases on the east side
(this [illegible] [illegible])

Sketches by Gray (c. 1830s) of the lay-out of the Edinburgh Museum made in preparation for the final move into the New Museum in c. 1840.

from 1836, through his great friend in the Museum, John J. Bennett (1801–1876), Keeper of Botany from 1858, and through his wife's interest in algae in which she was to become expert. His editing of R. A. Salisbury's *Genera of Plants* in 1866 has been mentioned above (44).

(f. 9) Some years afterwards [in 1836] when I had chiefly turned my attention to Zoology, a number of British Botanists who were chiefly young men and all unknown to me personally, formed themselves into a Society under the name of the Botanical Society of London (93), and invited me to become their President, as they looked upon me as the introducer of the Natural System of Plants to the British Botanist. The object of the Society was to read papers, to form a Collection and to receive from its members Collections of British Plants and to distribute them among the members to complete their herbaria. Mr. Watson, who was a Vice-President of the Society, undertook to examine all the specimens and see that they were properly named before they were distributed, and compiled the greater part of his *Cybele* from the Collection thus examined and a *Catalogue of British Plants* for the use of the members which has gone through many editions. Mr. Symes [sic], the editor of the last edition of the *English Botany* was the Curator of the Society's Collection.

After several years, [when] the Society seemed to have done its work of distributing well named specimens, [the] opportunity was taken of the death of several of the more active members and the removal from London of others to dissolve it [in 1857]. Portraits of the President, Vice-President and Secretary having been painted for the Society by subscription, on its dissolution it presented my portrait painted by Mrs. Carpenter [1793–1872] to the Royal Society.

Museum policy in the 1850s

In 1859, Gray appears to have discussed with some unnamed official his work of building up natural history collections in other institutions, from the duplicates that came his way. Whether or not this was a member of the staff of the Museum is not clear, but it may well have been with Professor Owen who had lately entered the Museum as Superintendent of the Natural History Collections. Gray's ideas were expressed in a letter which clearly summarizes his experience and opinions.

(f. 132) My dear Sir,

As you appeared interested in the observation I made with respect to the idea which I have long entertained of making use of the duplicates in the Museum of use to the different scientific and especially the educational institutions of the country I herewith send you an account of what I have hitherto done and the manner in which I think it may be carried into execution.

Finding with every care, it was impossible to prevent the Museum from collecting some duplicates and believing that with very little additional expense we might easily collect many specimens of the more common kind, in 1837 I induced Mr. Children, the then Keeper of the Zoological Department, to report to the Trustees that it would be desirable [and] to the Museum's great advantage [for] facilitating the study of Natural History if the Trustees would send series of duplicates properly selected and named, [based on] the outline of the arrangement of the Animal Kingdom, to the different local institutions. The Trustees entered into the idea but felt that it could not be carried into execution without the consent of the Treasury and they referred the question to their consideration. They replied as follows on ? July 1859 [reply not available].

(f. 133) [On] June 10 1859, a letter dated 8 June was read from the Treasury in answer to the Secretary's letter of 25th May.

The letter stated that "their Lordships respected the liberal feeling which had induced the Trustees to propose that the duplicate specimens of Natural History in the Museum should be distributed among the institutions; they were much impressed with the opinion that practically such a course would give rise to jealousies, discontent and complaints which on the whole would counterbalance any public advantage contemplated by the proposed course and therefore suggested the propriety of selling the duplicate specimens however small their value by auction in such a way as the Trustees might think more expedient".

This was probably a wise determination at that time as far as the government was concerned, but being convinced of the desirability of distributing the specimens sent, I have tried to carry out the plan privately as far as I have been able in my power making it a rule when a collection has been offered to the Museum to select the specimens only when we absolutely required and recommending the proprietor to send the remainder of its numerous series of the specimens to other institutions.

In 1845 when Mr. Hodgson (77) sent his very large collection of the skins and bones of Indian Mammalia and Birds to the British Museum and he was recommended to make a distribution of the duplicates – among the larger British and Foreign Museums, (f. 134) and with the consent of the Trustees the Museum undertook the distribution of them, and the same course was followed by the Museum with respect to the Fossils from India collected by Colonel Cautley and Mr. Falconer (94).

In the same manner when Lady Harvey (75) consulted me respecting the disposal of her Museum [before 1856] as it contained very few specimens required by the British Museum, I recommended that it should be sent entirely to the University of Oxford, and when similarly consulted by the Earl of Derby (87) I observed that we already had so many of the specimens it contained that it had better be presented entire to some Institution; it eventually becoming the Museum of the Town of Liverpool.

And more lately when the Juligi Society determined to part with their Museum, I pressed on the Secretary the diversion of the specimens which remained, after the specimens of more scientific interest had been selected, into a series to illustrate the classification of the animal kingdom, as to offer them to public institutions at a moderate price and where it is the intention of that gentleman to carry the plan into execution.

But these means, carry out very imperfectly the object I had in view when I recommended the plan. The Societies and Schools received a number of unnamed specimens which may often be duplicates of one another of the specimens they already possess. Instead of having sent to them a series of named specimens selected so as to illustrate the Classes, Orders and Genera of the Animal Kingdom according to the size of the collection sections of which would be rendered more complete by periodical additions according to the number of specimens at the disposal of the Institution.

(f. 135) At various times I have hoped to induce some Naturalist, or a Society of them, to form a Society for the purpose of distributing names of specimens of animals in the same manner as the *Botanical Society of London* have distributed named specimens of British Plants to their subscribers. The Society received the duplicates from the different members and sent them in return the species which they require to complete the collections. The Society in fact undertakes the machinery of, and verifying the nomenclature of the specimens, and distributing them to where they may be required as for example the Southern plants to the Northern subscribers and *vice versa*.

To give some idea of the facilities which the Museum possesses I may state that after using every care not to take more specimens of a kind that will illustrate the changes of growth, local varieties and the distribution of each species, (and such as are required to replace the specimens which may be deteriorated by exposure to light and the smoke and dust of London), we have added nearly half a million of specimens to the Collections within the last 19 years [thus written in 1859] and I believe that this number might have been very considerably increased with a very moderate additional outlay – so that the chief expense incurred in making the distribution would be the (f. 136) employment of a few additional assistants to make the selection and distribution of the specimens.

I may observe that a small, well-selected collection, is far more useful for study than a large and more complete one, as it often shows the well marked distinction between the Genera and large group which are graduated away in a larger series, and in making selections of the kind I think that care should be taken not to send the same series of specimens to all the institutions, so that the student may not be all cast in one mould, an evil much to be feared in governmental education.

[Letter on Museums Policy ends here.]

A Superintendent of the Natural History Collections, 1856

In 1856, the Trustees of the British Museum had resolved to appoint a Superintendent of the Natural History Collections, both to increase the status of science within the institution, and to effect the coordination of the four departments: Botany, Mineralogy, Zoology and Geology.

The following draft appears to have been written by Gray as a preamble to his application for the office, and so has been kept separate from the autobiographical passages that precede and follow it.

(f. 130) The Trustees of the British Museum having determined to create a New Office under the style of Superintendent of the Natural History Department, Dr. Gray begs herewith to lay before the Principal Trustees his application for the office, accompanied by a short statement of the grounds of his application.

. . . . . .

When Dr. Gray was first appointed Assistant in 1824 the whole Zoological Collection was restricted to two rooms not 50 feet square [50 ft × 50 ft (15 m × 15 m)]. That inevitably increased and was steadily increasing, both in extent in the facilities which it offered to the student, in 1834, so that when the parliamentary enquiry was pending in 1835/36, Dr. Gray was able to meet all the complaints made against it and its management before that committee. Since that period, as more room has been devoted to its development, it has been repeatedly increased until it has been almost unanimously allowed by all foreign Naturalists who come to consult it, to be the most complete in Number of Species, the best arranged and named in all its branches, the most easy of access and offering the greatest facilities for study of any Zoological Collection in the World.

Dr. Gray was appointed assistant in the Natural History Department on the 24th December 1824; Assistant of the Zoological Branch of the Department in 1837, and Keeper of the Zoological Department in 1840, and became Senior Keeper of the Natural History Department on the death of Mr. Koenig in 1851. Though Dr. Gray was first appointed and paid by the Trustees in 1824 he had assisted Dr. Leach (34) to arrange the Collection between 1817 and 1818 and Mr. Children from 1823 to 1824 attending regularly three days per week without any remuneration simply for the desire to render the Collections useful to the public and to increase his knowledge of the subject.

Dr. Gray, when first appointed, was employed under Mr. Koenig (51) in all parts of the Collection, and besides his knowledge of Zoology, to improve himself in Mineralogy, he formed a considerable private collection of Minerals (now with his daughter at Liverpool), arranged according to the most advanced state of the science; and from his knowledge of Botany he has been President of the Botanical Society of London from its establishment in 1836. In this period Dr. Gray wished simply to prove that he took an interest in all the branches of the department and was not likely to neglect or show partiality for any particular department.

Dr. Gray has made it a rule to spend the greater part of his annual vacations in visiting the different continental museums to make himself acquainted with the manner in which they are conducted and arranged, how named and catalogued, and to meet the different dealers residing on the Continent (95). The result has been that he has been enabled [to make] such a business connection with them that they uniformly make the first offers of all the specimens that come with their properties to the British Museum as the best customer who gives them the most rapid reply to their application.

Greater distribution of scientific works

(f. 136) Believing that books of a higher class are as much wanted in the Education Institute as specimens, in 1847 [1846] I was induced to write to Lord John Russell and sent a copy of it to Mr. [Thomas] Wise [MP] who had been my colleague on the Council of the Central Society of Education, the following letter (96):

British Museum
10 July 1846

My Lord

I beg to lay before you the following scheme for encouraging Literature and the Fine Arts and spreading a taste for them amongst the masses of the people.

1st. The Government should subscribe for a certain number (50 or 60) copies of the expensive Illustrated Works published in this country, for this purpose a large annual sum would not be required. Great care should be taken that only works of the highest character are thus encouraged.

2nd. That the copies so taken should be lent to different Mechanics Institutions, Schools of Design or other poorer associations of the kind; to be returned if the Institution should happen to be dissolved and then sent to other like Institutions.

The East India Company have for some years been in the habit of subscribing for a certain number of copies of works relative to India, but they give the copies to rich individuals and endowed and public Libraries which would otherwise often purchase such works and the sale is thus injured. Yet under their patronage many very valuable and beautiful works have been published.

As I am almost unknown to your Lordship I may state I have had some experience on this subject, first as being the author of the *Illustrations of Indian Zoology* [Gray, 1830–1834] which was the forerunner of the magnificent works of *Lear*, *Wallich*, *Gould* (97) and others. Secondly, as the founder of the largest and most flourishing Mechanic's Institution near London, and lastly from my position in this establishment. I am constantly consulted by Authors, Artists and Publishers of the kind of works referred to. I am therefore well aware of the difficulties under which they labor and know that if this kind of encouragement was given, several works which have been deferred for years would be readily undertaken and from my experience of the feeling of the working classes I am certain it would be regarded as a great boon and that having such works within their reach would have an important effect in improving the taste and encouraging the study of Natural History and Architecture amongst them.

I may further observe; there are several Illustrated Works entirely prepared at the government expense which might be sent to these Institutions at scarcely any additional cost: as for example the Descriptions of the Marbles (containing engravings of each Statue) the Catalogues of the coins and MSS (containing engravings) published by the Trustees of the British Museum: The Report on Geology published by the Stationary Office: The Beautiful Maps published by the Ordnance Office & the Hydrographic Office of the Admiralty.

It has also been usual of late for the government to make grants to assist in the publication of certain works, as for example, the New Animals and Plants discovered in Voyages of Discovery. Under this plan have been produced the Zoology and Botany of the Arctic voyages of H.M.S. Blossom, Beagle and Sulphur, and now of the Antarctic voyage (98).

I believe the plan here recommended of subscribing for a certain number of copies would be more advantageous, as these grants in reality have only been *bounties to certain publishers*, and the works have had a very limited sale and often eventually got into the hands of some speculating publisher of second-hand works. In conjunction with Sir John Richardson M.D. I am now editing the Zoology of H.M.S. Erebus & Terror (99) assisted by a grant from the Treasury. This work unlike others of the kind has been kept in our own hands and therefore should the government think it desirable there is no difficulty to the government receiving without extra cost 50 copies of the part as soon as completed for distribution.

In the subscription list of Dr. Falconer's & Colonel Cautley's work on the Fossils of the Himalayah (94) I see the government down for 50 copies. I do not know what is intended to be done with them, but they might be applied to the same purpose.

I am my Lord
Your most obedient Servant
John Edward Gray

To the Right Hon. Lord John Russell, M.P.
and Thomas Wise Esq. M.P.

(f. 136) contd. They [Lord John Russell and Mr. Wise] both informed me that they would take the suggestion into consideration but as yet I have never heard that the plan has not been acted on. Since that date several grants towards the publication of Natural (f. 137) History works have been made but for some reason the grants of several have not been demanded and the works have not appeared. The one or two which have been offered have proved how completely such grants fail in the object intended. On the other hand since that letter was written, a series of Catalogues of the Zoological Department of the Museum with the sanction of the Trustees have appeared, some of them from the first zoologists of the day. I am aware that the earlier catalogues were mere lists of the species contained in the Museum but they have gradually improved in their form as the Trustees felt themselves at liberty to encourage their publication and lately some of them have grown popular and others are woodcuts illustrating the genera and showing the more interesting and newly described species contained in the Collection. They are not as yet as perfect as I could wish, as I should desire that they should combine with the scientific character of the text the higher degree of artistic talent combined with the regular degree of scientific accuracy, and as each catalogue has appeared that has been the desire aimed at.

These catalogues are sold at the cost price of production and some have had such (f. 138) a sale (though they are only partially advertised) as to call for a second edition, and the Trustees have given them to various scientific institutions which have requested them, but there could be no difficulty in their being more extensively translated if it were considered desirable as the loss if printed a certain number of extra copies when the work is in proof is but a small item in the general cost.

One sometimes sees in the List of Subscribers to Works, some of the government offices, as the Foreign Office for example, down as a subscriber for a number of copies of Works of Travels, and I have been informed that these copies are distributed. If the plan I mention was adapted it would produce a machinery by which all the works supported by the government might be described in a definitive manner in such a way as the most advantageous to the public and author, and least injurous to the publisher and through him the general public.

Gray's difficulties and achievements

In May 1869, Gray suffered a stroke more disabling than any of the series that had started from his sixtieth year. Evidently thinking that he would not long survive it, William Flower (80), then Conservator at the Royal College of Surgeons, anticipating an obituary, wrote to Gray who dictated a reply on 14th May. Another letter to an unknown enquirer was written in 1873, and both are reproduced here. They show not only what Gray considered he had achieved, but also the difficulties that had been put in his way.

"To William Henry Flower F.R.S., Royal College of Surgeons
British Museum
14 May 1869

(f. 128a) My dear Flower

In reply to your question I send you the enclosed notes; you may use them at your discretion.

When circumstances rendered it desirable that I should study medicine I attended the lectures on Botany at Maze Pond given by Mr. William Salisbury (31). When he failed [in business] (100) I was requested by the Class (Clift being one) to finish the course although yet a lad. Being fresh from reading the very scientific papers of Robert Brown [1773–1858], of R. A. Salisbury (36) and the works of Jussieu (41) and Decandolle [de Candolle] (37) then hardly known in this country, I lectured on the Natural Arrangement of Plants of Jussieu and with my father in 1821 I published a work containing an Introduction to Botany and a Flora of Britain being the first elementary work and Flora of Great Britain published on the system. The elder botanist(s) objected to the innovation but the system is now universally adopted. I continued to lecture at Maze Pond and Hatton Garden School and gave a course at St. Bartholomew's to my fellow pupils there before 1821.

In one of my ethnological excursions I became acquainted with Dr. Leach (34) and I assisted him at the Museum between 1817 and 20 (101). I was in hope of succeeding him or rather of being temporarily employed while the situation was kept open for him in the hopes that he [would] recover but failed.

In 1822 I became acquainted with Mr. Children (58) and at his request assisted him without pay until 1824 when at his request I was temporarily employed at the Museum at a daily salary and it may be said that the present zoological collection has been formed by me. When first there I paid for the spirit and bottles out of my own pocket. Before the Parliamentary Committee of 1836 there was a small grant for Natural History generally, but Mr. Koenig spent it all for minerals, and as he had control of the fund, the share to zoology was very small averaging under £20 per ann. but this was altered in 1836 on my recommendation. The Zoological Department was separated from the other and had a grant of its own and from that time may be dated the creation of the present collection. Before 1836 the whole zoological collection was contained in a few small rooms. Mr. Children kindly allowed me to have control of the department and grant and in 1840 when he resigned I was appointed Keeper. I added the collection of osteology in 1845 when Mr. Hodgson (77) offered his collection. At my suggestion he offered the collection of skins if we would accept the bones with them and not without, the Museum accepted. Before that period Sir R. Inglis (67), at the instigation of the Curator of your Museum opposed the purchase of the bones and even our having skeletons prepared from any animal we received in the flesh as he said it was injurious to your [our] institution. Soon after I was appointed I commenced the Catalogues but I had much opposition to encounter. As the other departments did not publish them I was obliged to commence with small lists of names only, then lists with descriptions of new species and some synonyms, but I could not exceed the 12mo size. At length I was allowed to add the description of all the species and some illustrations and print them in 8vo. Then I commenced some 4to catalogues illustrated with plates, more of these would have been published but some objections were offered by Professor Owen [1804–1892] to the last and no more have been printed.

Knowing how little time I had for the work myself and how much better a person with a speciality could do the work I employed certain persons to make a catalogue of special portions of the collection, that is how Dr. Günther was first employed and how Dr. Kaup, Dr. Hagen, Mr. Desvigne, Mr. Dallas, Mr. Westwood, Mr. Wollaston, Mr. Newport and others were employed (102). It required considerable discretion to induce them to undertake such work. Lately Prof. Owen, by a new reading of the

John Edward Gray, c. 1872–1874. From a photograph.

regulation under which he claims the right to alter the MS., has caused Wollaston, Hewitson and all the other persons I employed (except F. Walker) to refuse to undertake any other work of the kind so that I can now only depend on my own labour and those of my assistants. I do hope the evil may be remedied when he sees the effect his order has produced.

No one knows the difficulties that have been put in my way whenever I tried to take a step in advance either as to extending the collection and preparing Catalogues. Mr. Panizzi (103) set his face against all printed Catalogues.

With kindest regards
My dear Mr. Flower
Yours ever sincerely
John E. Gray [in own hand]

William Flower, F.R.S.

Letter to an unknown correspondent

(f. 109) 26 May 1873

My dear Sir,

Thanks for your note and its contents. I send you a continuation of my former letter.

Yours very truly,

I have studiously avoided uniting myself to any party in Science or among scientific men, as Science is progressive, and one's opinion changes, and a party after a time becomes a defender of what is not for the best. Such a person I am aware has to pay the penalty of unpopularity, and of not having the rewards usually given to partisans, and therefore I do not make the following statement as a complaint, which no doubt would not have occurred if I had acted differently, but merely as a matter of experience.

I have had some influence on the Botany and Zoology of the country. In early life I introduced the Natural System of Plants to the English reader which is now, after fierce opposition, universally adopted. I established the Botanical Society and was President of it the many years that it existed because the members considered me the "apostle of the Natural Method". That Society was the foundation of the '*Cybele Britannica*' of Mr. Watson and the basis of the best 'English Floras' of Symes, Hooker etc. (93). I have formed at a very modest outlay the largest and best arranged Zoological Collection in existence, and conducted it in such a manner as to make it the most accessible to students of this and other countries. I have done my best to form and see after the arrangement of local collections in England and Australia. I have spent my vacations in visiting all the Museums in Europe at my own expense, and in the more important ones repeatedly to keep myself acquainted with their contents, regulations and management. I have published several scientific books, not as a matter [of] trade, but for the extension of zoology, both as works of local zoology and as Catalogues of the Collection in the British Museum. I have published several papers in the [*Philosophical*] *Transactions* of the Royal Society and more than a thousand Essays on Natural History in the different journals the larger proportion of which is in the Royal Society Catalogue, but the number is greatly increased in a private list which I have printed [Gray, 1875] independently of the many Essays on Social, Educational and Economical subjects only of temporal interest, I have not thought it worth while to keep a list.

(f. 110) I have studied every branch of Zoology some more in detail than others and have paid most attention to the part which I thought was most neglected, and I have done much to extend our knowledge of mammalia and Reptiles. [I have] collected in the Museum every class of animals, arranged them as best I could, and put them aside until a student of the parts that I could not attend to in detail should arise.

> I have produced a thorough revolution in the study of Mollusca and their Shells which has been universally adopted in England, in Germany, and partially in France, for there they only make starts in science by jumps, and zoology, since the time of Cuvier and Lamarck (49), has been in a state of quiescence.
>
> After all these exertions in the cause of Natural Science I have not been considered worthy by the Royal Society of receiving their Royal Medal. I am almost the only naturalist, a Fellow of the Royal Society, who has had papers published in the [*Philosophical*] *Transactions*, that has not received that Medal, and some have received it on very small claims, and several who have not even written papers for the Society. I believe that an aged botanist, a contemporary of my own in my youth who has published much on botany both in the Linnean Society *Transactions* and independently but has not published a paper in the [*Philosophical*] *Transactions* of the Royal Society, has been equally forgotten with myself.

Social and cultural interests

That the conditions under which Gray served his apprenticeship predisposed him to question social conditions, is evident from what he records in his *Autobiography* of his adventures as a surgeon's assistant at Wapping, and by his concern as a young man for the abolition of the slave trade and for prison reform. After 1826, marriage and residence at Blackheath brought him into the affairs of the local community and into local government. That year he went on his first continental tour (he had been to Paris to study before), returning with broader cultural interests, which took the form of concern for some neglected portraits in Montagu House.

Royal portraits

(f. 74) [In 1827] I had to go to the attics of Old Montagu House for Mr. Children (58), who like the Officers, had a room there. I observed a large series of oil pictures without frames and in the passages a number of frames without pictures. At my leisure I fitted the pictures to the frames and hung them up over the book cases of the rooms that were occupied as studies of the Zoological Department, placing the series of Kings in the largest room and the other pictures where they would best fit. I incurred a good deal of ridicule because I placed the picture of Oliver Cromwell in the series of Kings.

> It is an instance of the perverseness of man, showing how one gets punished for good actions. When they were moved into the New Gallery [of the new British Museum] over the King's Library, the upper part of the room was set aside for the series of pictures which they now occupy (104), so that the Zoological Department was deprived of space by my taking care of them, as they occupy the part of the Gallery which in my plan was intended for the cases of fish, reptiles etc. in spirits arranged in opaque cases. It is to be hoped some day that the greater part of them indeed all that are worth keeping will be incorporated with the National Portrait Gallery which they would much enrich.

Mechanics Institutes

(f. 12)
(f. 77) After my marriage [in 1826] I lived at Blackheath (105) and took an interest in my neighbours. One day Mr. Mallet informed me that the Society (106) which had existed for several years was going to meet that night to be dissolved. I went at the time appointed, introduced myself to the few persons present, among others, to Mr. John Bennett (107), one of the Secretaries, the present Sheriff of London, and proposed that the Society should be kept together for at least another year and that instead of being dependent upon subscriptions and donations, the members should put their shoulders to the wheel and depend entirely upon their own exertions; that I and a few of my friends would join the Society as members but would only pay the common subscription and act as the other members of it.

We gave lectures, established a lending library to which I lent, but afterwards gave a few hundred books. The Society soon became a success, the only difficulty we had to encounter was the opposition of the established clergy of Greenwich and their supporters. They succeeded in getting us turned out of two or three school rooms rented to lecture in. Eventually the Society built a theatre, most excellent reading rooms which Mr. Wise said were better than any then existing club in London and a large school attached to it. The Society is still prospering though most of the Institutions of the same kind called Mechanics Institutes or some similar name have ceased to exist.

After the passing of the Reform Bill [in 1832] I took some interest in the election for West Kent and also the Borough of Greenwich (108). Some of the members of the Greenwich Society consulted me whether I would stand for the borough but I at once declined as it would be inconsistent with my duties and interfere with the object I had set myself to perform. A larger party memorialised the Government that I should be put in the Commission of the Peace. I had some communication with the Government, but declined from the cause above cited, but at the same time recommended as more fitted for the occupation my friend Mr. Thomas Lewin, a barrister and man of leisure and brother-in-law of Mrs. Grote. He was appointed. The Conservatives wished to know if I would accept the being named as a member of the Turnpike Trust, but I declined on the same grounds, feeling sure that I never could attend either as a magistrate or trustee except on particular occasions when I should have to vote on a party question.

Life saving

(f. 17) When in Hamburg [in 1831], having observed that they used a wicker boat covered with hide and having an open well in the centre for the recovery of persons who had fallen into the water, I purchased one of these boats and presented it to the Royal Humane Society (109) and this boat served as a model for all improved machines that are now in use for the recovery of persons who have fallen into the water by which they are taken out of the water by a [boat] with a central vacancy and not as formerly from a side of a boat. The Humane Society elected me an Honorary Life Member (110) for the interest I had taken in the subject.

Shortly afterwards M. Le Roi d'Etoile [sic] (111) was staying with me and drew my attention to a pamphlet that the use of bellows for the recovery of drowning persons if employed effectually was sure to kill them, even if they were not drowned. [In 1832] I sent a pamphlet to the Humane Society and finding out they did not understand French, I had it translated for them. Not hearing that they had taken any steps to put an end to the use of the bellows, I wrote to them again and found that I had made a mistake in supposing they had immediately adopted the conclusions of the pamphlet, (f. 18) and was informed that if they did, it would have a bad effect on the Society (112), they overlooking the fact that anyone who searches the history of the Society will find that with the improvement in knowledge, almost all the means they had at one time recommended for the recovery of persons, had gradually been moved into the list of means that were to be avoided like the hanging up by the heels, and rolling in a cask.

On thinking on the question it appeared to me that artificial respiration might be induced by the regular alternate compression and relaxation of the chest, and I found it quite successful in the case of a child that had fallen in the water, when I used a long towel tied round the chest with a stick inserted so that the chest was contracted [when] twisted, and it dilated of its own elasticity when untwisted, but this was too simple for the Society or rather I had lost their confidence. They referred the question to a Committee of medical men and they recommended that the chest should be contracted by a bit of linen torn into strips at each end, and interlaced, and each end to be pulled by a separate person, not seeing that it would not act without the operators acting in unism, a thing very difficult to obtain especially between two strangers, whereas the single towel and the stick was like a tourniquet and entirely under the control of a single operator.

Insanity

(f. 13) Experience has taught me that it was necessary, if I was to retain my mind in a fit state to do its work, that I should vary my labours by taking up now and then some object of study.

My medical education has made me take interest in the health of towns and in the improvement of Sewage. At length the Government saw the necessity of undertaking this question (113) and I received an offer from them to be appointed Officer of Health. I stated I did not wish to give up my present appointment and duties, but I recommended a young medical man whom I had known for some time and believed to be fitted for the post, and he was appointed.

In the same manner I took a great interest in the treatment of the insane. As the treatment of the private madhouses and charitable institutions had been improved, I observed that of the Army and Navy was carried out in the old barbarous system. I did my best to call the attention of the Government and to interest the officers in charge of these institutions in adopting the improved method, and got my friend, Sir J. Richardson (99), to bring the question of the management of Haslar before the Admiralty, and took him to see the lunatic asylum at Hanwell under the direction of Dr. Conolly (114). Dr. Richardson made several reports upon the great improvement in management and on the diminution of expense to the Admiralty, who at length gave him directions to introduce it into Haslar Hospital that was under his charge and he recommended that his assistant, Dr. Anderson should be appointed to carry the alteration into effect and we had the happiness of seeing its beneficial influence on the patients.

Penny postage

On the subject of Penny Postage (or rather what led up to it in its final form) Gray wrote or dictated no less than six versions of what he considered his contribution to have been, and like that in his *Hand Catalogue of Postage Stamps* (Gray, 1862), not all are carefully expressed, so that there is little to be gained by placing the versions along side each other. The present writer would not go further than to admit Gray's claim that, after reading H.B. Parnell's (1846–1891) *On Financial Reform* (Parnell, 1832), he suggested a 'small uniform rate of postage be *pre-paid* by stamps' at the receiving office.

(f. 139) I am well aware that the best of schemes even such as are declared to be the greatest benefit to humanity and when once established and gradually become of very general adoption require long and continuous agitation before they can be adopted. This is well illustrated by the "Penny Postage" . . . I don't mention this subject with any intention of claiming any part of his (Sir Rowland Hill's) well earned reputation for
(f. 140) I never could have bestowed even if I had the talent, the labour which he devoted to the subject without neglecting my duties at the Museum, the improvement of and the extension of the usefulness of which was the aspiration of my early youth and has been my continued desire.

(f. 15) Having read Parnell's [Baron Congleton] work on Taxation and then having seen that stamps were the most economical system of collecting money for fiscal purposes and observing that newspapers were carried by the post when stamped, it occurred to me that stamps might be beneficially applied to the postage of letters. When Mr. Hill (115) had shown that the distance which letters were carried was a very small part of the expense and he proposed a uniform rate of postage, I suggested and used my best endeavours to have that postage collected by stamps, but my chief opponent was

Mr. Rowland Hill, who in both editions of his pamphlet and in his evidence strongly urged the advantage of the postage being paid in money, but when he found that the (f. 16) issue of stamps was to be tried, he recommended the adoption of a pictorial envelope (116) which so disgusted the public that it was obliged to be given up, and the stamps became universally used in its place.

The use of stamps has been adopted for collecting various other duties, and in nearly all the different parts of the world. Oddly enough Mr. Hill, who recommended the penny postage on the grounds of its economy, seems to have been alarmed at his own plan, and urged the use of stamps being left optional, so requiring a large staff to keep the account of unpaid letters sent to or from the different post offices, which as I have repeatedly pointed out, might, by a very simple arrangement be obviated, the postage on unpaid unstamped letters being collected by the post-master of different places who had to deliver them, he putting on stamps for the postage and receiving the money for the stamps so put on, from the receiver.

John Edward and Maria Emma Gray were among the first, and were perhaps the first joint, stamp collectors. Unable to resist making a catalogue, Gray's *Hand Catalogue of Postage Stamps* (1862) was among the first five to be issued in Britain (117). The Catalogue went through four editions before being taken over by a professional editor, Overy Taylor in 1870.

(f. 14) I collected the postage stamps used in different countries and finding that the collection of them became a kind of rage and that it might be useful in extending a knowledge of geography among the public, I printed a Catalogue of them. This Catalogue has gone through several editions and now seems to have supplanted several imitations of it, that were published.

Decimal coinage

(f. 14) [In 1853] I became interested in the agitation to introduce a decimal system of coinage. I wrote a letter that appeared in the *Times* (118) on the Poor Man's Penny, and at length took such interest in the question that I collected all the books and papers written on different sides of the question, and made a collection of the various coins in circulation in different parts of the world. I placed these collections at the disposal of the Royal Commission (119) appointed to examine into the question, which for a time occupied considerable attention.

During the time of the discussion the Master of the Mint died, and it appears to have got abroad that I was a Candidate for the situation from the attention that I had paid to coins and coinage. I received a visit from Dr. Graham (120) and Mr. Brande (121), who were both candidates to know if there was any truth in the report. I soon put their minds at rest by informing them that I only studied the subject of coin and coinage as a diversion and was satisfied with my present position. I suppose that my letters and evidence on this subject showed that I had mercantile capabilities for I had offers from more than one commercial house to join them and to become a Director of more than one Company.

On Francis Galton's eminent men

In 1874, within a year of his death, Gray was reading Francis Galton's (1822–1911) recently published *English Men of Science, their Nature and Nurture* (1874). Partly paralysed, and unable himself to write more than a few words, he dictated the reactions which illustrate his social philosophy. In his solution to the problem of human betterment, Galton inclined to favour an 'elite' of an educated upper class, but in this volume he fell into a strange contradiction which Gray, whose concept of society did not include an 'elite', was quick to spot. Galton could not both claim that his upper class was replenished from below, which had been a constant feature of English society, *and* that his lower class remained as a 'residuum' (see f. 41 below).

In making his case Gray named eight scientific institutions (see 39 and 42 below) which, in 1874, employed about forty scientific men and mathematicians. On a recent analysis, as far as it can be made, it seems these men received education at one of three 'levels', to a great extent representing their social class:

		Nos. involved
Upper Level	University or medical	14
Middle Level	Good school and/or parent having some means of influence to guide career	17–19
Lower Level	Boy from poor home, making own way	7–9

Those educated at a 'lower' level, whom Gray may have had in mind in showing that ability was no monopoly of class, were:

Thomas Davies (1837–1892), mineralogist, British Museum.
N. E. Brown (1849–1934), Royal Botanic Gardens, Kew.
John Lindley (1799–1865), botanist, University College, London.
Henry Keeping (1827–1924), Woodwardian Museum, Cambridge.
W. C. Williamson (1816–1895), natural history, Owen's College, Manchester.
John Phillips (1800–1874), geologist, Oxford.
William Ellis (1828–1917), Royal Observatory, Greenwich.
William C. Nash (1841–1926), Royal Observatory, Greenwich.

As Gray realized, his family over the generations was in no way inferior, in spite of the poverty of his father, to the Galtons, and having himself risen the hard way, Gray found himself more in sympathy with the self-made men of the period than with any, so-called, 'elite'. What Gray had lacked in education remained as a recurrent irritant in his mind.

In childhood, illness and poverty had combined to deny him formal schooling, mainly in literature and the classics, while his medical education had been of such a nature as to place it below an accepted university level. Hard though his years from 16 to 23 had been, however, a university could hardly have given him more.

(f. 32) I understand, when I received Mr. Galton's questions, that the answers were to be published and therefore only wrote on the form what appeared fit for that purpose, but Mr. Galton seems, when he saw the answers, to have changed his mind, and to have only published extracts from them anonymously, and I think when one sees many of these extracts that he has judged wisely. He very truly observes, p. 147, that many of his answers were "due to reticence on the part of the writers" and "Again many men are conceited, but their differences" do not much affect those results.

(f. 33) The replies Mr. Galton has received to his printed questions were 180 and he has selected rather more than 100 of these for statistical treatment, and he states "It must not be for one moment supposed that mediocrity is unduly represented in my data." (p. 11).

(f. 34) One-third of those who sent replies have been educated at Oxford or Cambridge, one-third at Scotch, Irish, or London Universities, and the remaining third at no university at all. I am totally unable to decide which of the three groups occupies the highest scientific position: they seem to me very much alike in this respect. (p. 236).

A curious admission considering the author's predilection for a university education, and I think it is a proof that the answers he has received are not a fair test of scientific merit, at least as far as regards natural science – according to my experience. Some of
(f. 35) the answers, for example, are extraordinary. Thus it is given as proof of energy (Chapter II):

7. Strong when young – walked many a time fifty miles a day without fatigue, and kept up five miles an hour for three or four hours. (p. 80).

> 21. When a boy of 13, I walked 48 miles in one day, 50 miles the next, and about 20 miles the third. (p. 88).
>
> As a boy, I worked for three months all day and all night, with not more than four or five hours sleep. (p. 93).
>
> 8. When under 20, I have walked 20 miles before breakfast; when about 32, walked 45 miles; dined and danced till 2 in the morning without fatigue. At the age of 26, during 14 days, was only 3 hours per night in bed, and on 2 of the nights was up all night preparing for . . . [certain scientific work.]
>
> (f. 36) At aet [age] 6, I was given Joyce's *Scientific Dialogues* (122), which I soon mastered, then other books; before aet [age] 8, I commenced making star maps; aet [age] 12–13, I made some geological sections with tolerable correctness: and so on. (p. 176).
>
> He (Rowland Hill) was noted in youth for powers of mental calculation and in some points was superior even to Zerah Colburn (123) and George Bidder (124); thus he could mentally extract to the nearest integer the cube root of any number not exceeding two thousand millions. (p. 53).
>
> I suppose it was such accounts that Mr. Galton means when he speaks of "too emphatic narration of early achievements." (p. 147). Indeed I cannot say that the replies confirm Mr. Galton's estimate that vanity in scientific men is at its minimum. (p. 148).
>
> (f. 37) It appears to me that the answers Mr. Galton received cannot be a fair representation of the typical scientific men of the country. First of all I do not think that his definition of a scientific man is very conclusive, and certainly excludes sundry men who take a high station in science.
>
> There are men who certainly have done work, but have not received a medal, and there are other scientific (125) men who do not belong to Dining Clubs; indeed it appears to me that a great part of Mr. Galton's method of selecting scientific men seems rather to belong to the social qualities than to their scientific eminence. A (f. 38) different criterion of eminence is found in the number of eminent men reared in the universities whither a large proportion of the highest youths of the nation find their way.
>
> (f. 39) For example, at least 3 of the Professors of Natural Science in Oxford did not receive a university education and it is natural to suppose, if they were capable of finding a member of the university, they would rather choose him than select a man who has been engaged in trade for the greater part of his life. In Cambridge they have selected for the arrangement of the Woodwardian Museum men who were not educated in the University. In University College and in King's College (London) the Professors of Natural Science have not received a university education nor even have been educated in their own schools.
>
> (f. 40) The Keepers of the departments in the British Museum, belonging to Natural Science, and the Superintendent of Natural History, have all but one not received a university education, neither have the assistants of any of them, even of the keeper belonging to Oxford, and it is the same with the keepers of the other departments of that Institution – there being only one or at most two university men among them. It is natural to be supposed, considering who has the patronage, that university men, if they had the qualifications, would be appointed. Perhaps we shall read Mr. Galton's remark as a prophecy of what he hopes will be the future and not as a description of what is.

In the first chapter of his work, entitled *Antecedents*, Galton outlined the basis of his thesis and discussed the 'Occupation of Parents and Position in Life', in relation to their offspring. Galton concluded that:

> It is by no means the case that those who have raised themselves by their abilities are found to be abler than their contemporaries who began their careers with advantages

> of fortune and social position. They are not more distinguished as original investigators, neither are they more discerning in those numerous questions, not strictly scientific, which happen to be brought before the councils of scientific societies. There can be no doubt but that the upper classes of a nation like our own, which are largely and continually recruited by selection from below, are by far the most productive of natural ability. The lower classes are, in truth, "the residuum". (p. 23).

Gray's reply to this thesis of Galton's was emphatic:

(f. 42) I must say that this is the direct opposition to all modern history, and certainly opposed to my own experience. Thus the origination of the Arkwrights, the Rennies, the Brunels, the Stephensons [George and Robert]; Smith, the geologist; Black, Priestley, Davy and Faraday, the chemists; R. [Robert] Brown, Lindley, Hooker, [the botanists]; Wallich [oceanographer] had not fathers, or when they began life, did not possess the advantages of fortune or social position, they did not belong to the upper class; [yet] they have been great improvers of science and although some of them have founded families, all belong to Nature's Aristocracy.

(f. 42) I would observe from my own experience that the majority of the Keepers and of the senior and junior assistants in the Museum, and the scientific assistants in Kew Gardens, three of the professors of Natural Science at Oxford, the Professor of Natural Science at Owen's College and the Professor of Natural Science at the University College and King's College and several of the assistants at the Royal Observatory who, one would suppose, are chosen for their knowledge of the subject. They have made use of the opportunities that their situations have given them to make themselves leaders and improvers of the sciences which they study and teach. Their fathers and they had not at the time of their appointment the advantage of future social position, and one might quote very many other instances, but it would be invidious to do so.(126)

Personal reflections

Although Gray did not write much about himself as a person, except in his letters, for instance to Mrs. Rose Mary Crawshay (1828–1907) (Gunther, 1975, chapter 15), there is generally a strong subjective element in what he wrote about his work.

(f. 110) I do not know anything more difficult for an individual to describe than his own peculiarities. There are so many causes for his misunderstanding himself, but, judging from the observations and remarks of others, I should say that my character consists as if often the case of two very opposite qualities. First I am fearless and very obstinate in doing what I think is just and almost genuinely affectionate to those who are in distress and wanting my assistance, as is well expressed by Dr. Sharpey (127) who observed, that "Gray is said to be a quarrelsome man, but that is scarcely a fair description of him. He will knock you down if he thinks you unjust or untruthful (128), but at the next minute he will give you his hand and be your friend if he thinks you want his aid."

On the working of the mind

(f. 6) I believe that with energy and a well balanced mind, which generally produce business habits, a man with a scientific turn of mind may study with advantage any branch of science and change them [his habits] according to circumstances, or as he sees it to be to his advantage. That is the result of my own case.

(f. 11) [In 1829] I undertook, if General Hardwicke (129) would give to the Trustees for the Museum his collection of drawings and such books in his library and specimens in his collection as were desirable, that I would figure a selection of the animals drawn under his direction and to publish a Fauna of India (130). I worked at them at home of a night after I had finished my duties at the British Museum during the day. It was

> all very well for a time but at length my mind was overworked and gave way. I struggled against it as long as I could, but at length determined on giving up doing more in zoology than was absolutely necessary at the Museum, and determined to try the effect of changing my occupation and oddly enough, as many people will think I took to the study of theology and with such energy that I had thoughts of becoming a missionary rather of the Moravian type (131), but by degrees as my mind recovered its tone, I returned to the study of zoology.
>
> The overworking of the brain on the same subject produces fatigue of the brain more permanently than is generally suspected. During the time I have been Keeper of Zoology 4 Assistants have suffered more or less severely from this dreadful malady.

It was Maria Emma Gray who was the pianist and concert-goer, but doubtless John Edward turned his mechanical talents to improving the instrument, and it would have been unlike him not to suggest that Miss Broadwood adopt his ideas as the following note suggests:

> (f. 53) You may add that Dr. Gray was much attached to the study of music and introduced some improvement in the construction of the piano which we [offered?] to Miss Broadwood (132).

Zoological manuscripts

The drawings and other illustrative material assembled by J. E. Gray and held by the Zoological Library of the British Museum (Natural History) show the style of work he adopted when he joined Children at Montagu House in 1824. The first task Children gave him was to compile a Catalogue of Reptiles (Gray, 1825); but it was clear that he soon decided that the whole animal kingdom should fall within his demesne with the object of building up a *Systema naturae* on the Cuvier model. The method adopted was to cut illustrations out of whatever printed sources were available, stick them on stout cartridge paper sheets of standard size ($8\frac{1}{2}'' \times 10\frac{1}{2}''$) (21·5 cm × 26·7 cm) (identified today by watermarks of 1824, 1825 and 1826), label them, add a reference or two and notes as he went along, and occasionally a drawing or tracing of his own. How many genera he made folders of we do not know, but of his *Systema* there are still preserved many hundred sheets in total for Mammals, Birds, Reptiles, Shells, Crustacea, Mollusca and Protozoa.

The most complete example of Gray's method is seen in his work on Mammals, the group to which he contributed most. His *Systema naturae*, built up of cut-outs pasted on cartridge sheets fills five boxes (88.q.G: Wm. 1824–1826) which gave the foundation for his volume on the Mammalia, being Volume 5 of E. Griffith's *The Animal Kingdom* (Gray, 1827).

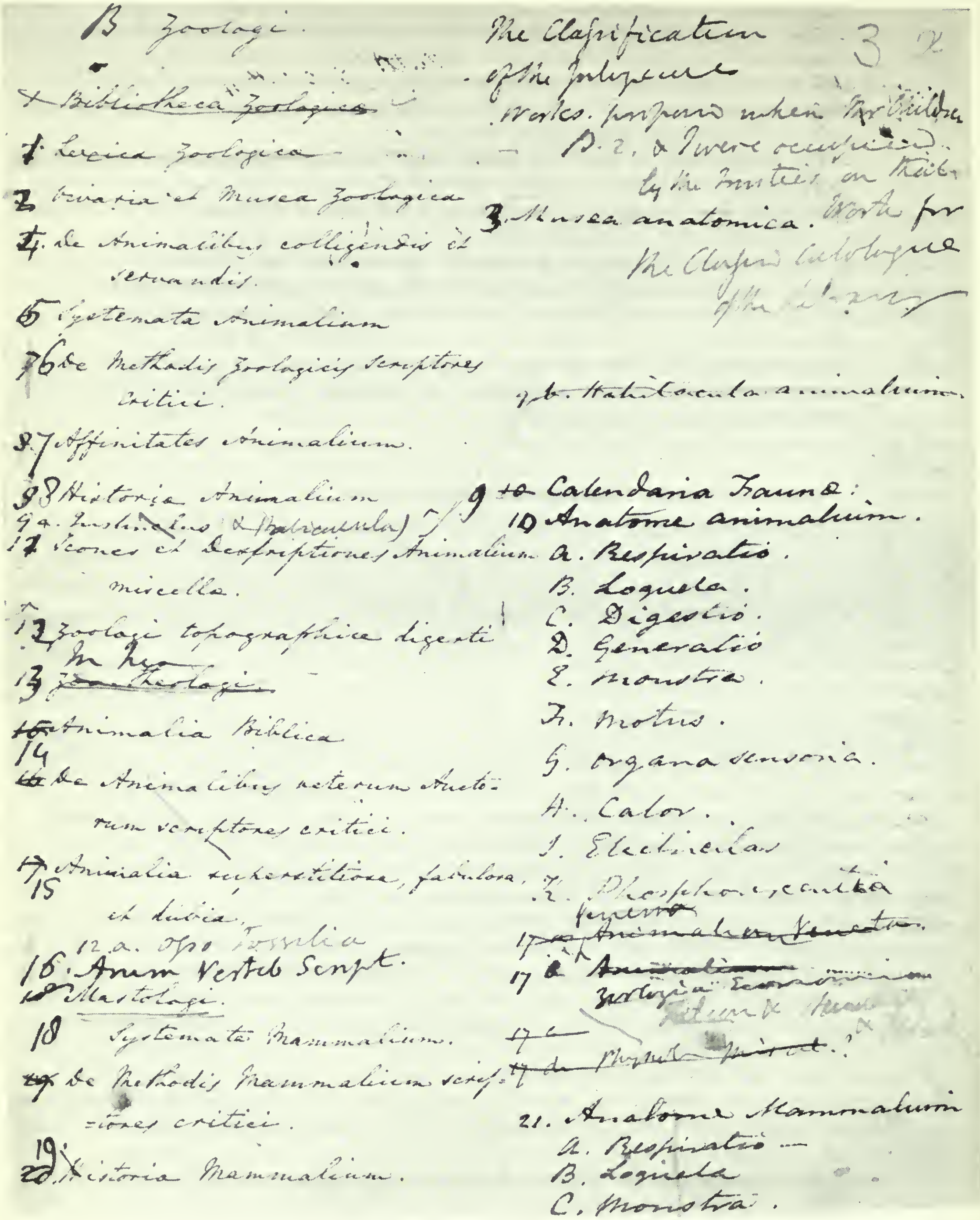
There is usually a documentation gap between this early *Systema* and the first formal List or Catalogue. For Mammals, the List was preceded by four pocket-size account books (89.d.G: Wm. 1842) with notes from literature and foreign museums (presumably made on visits to the Continent), all of which developed into a later *Listing Mammals in Systematic Arrangement* (89.o.G: Wm. 1837) going up to the year 1842. The first catalogue (called a *List* at the time) is dated 1843 under the title of *List of the Specimens of Mammalia in the Collection of the British Museum* (Gray, 1843).

Whenever Gray started to lay a foundation for any group, the same procedure is followed: for birds, reptiles, mollusca, crustacea, etc. Birds have no less than seven folders, the cut-outs coming mainly from: Latham (1781–1787), Pennant (1776–1777), Bonnaterre (1782–1832) and Griffith (1827–1833).

No list or catalogue was made of birds as their care in the Museum passed to Gray's brother, Robert in 1831.

Reptiles go through the same process with a build up of cut-outs on cartridge sheets with watermarks of 1824, 1825, which in their case led to a *Synopsis of the Genera of Reptiles* of 1825 referred to above, and to the *Synopsis reptilium* of 1831 and 1834 (Gray, 1832 and 1834).

To give an idea of how much may have been lost, there is, in the case of Reptiles, little material between the build-up for the Synopsis of 1825 and a collection of material made about 1870–1873



B Zoologia.

x Bibliotheca Zoologica

1. Lexica Zoologica

2. Vivaria et Musea Zoologica

4. De Animalibus colligendis et servandis.

5 Systemata Animalium

~~7~~ 6 De Methodis Zoologicis scriptores critici.

~~8~~ 7 Affinitates Animalium.

~~9~~ 8 Historia Animalium

9 a. Instinctus (& Habitacula) 9

11 Icones et Descriptiones Animalium miscella.

12 Zoologia topographice digesta

In hoc

13 ~~Zootheologia~~

~~16~~ Animalia Biblica

14

~~16~~ De Animalibus veterum Auctorum scriptores critici.

~~17~~ 15 Animalia superstitiosa, fabulosa, et dubia.

12 a. Ossa Fossilia

16. Anim Vertebr Script.

~~18~~ Mastologia.

18 Systemata Mammalium.

~~19~~ 7 De Methodis Mammalium scriptores critici.

19 ~~20~~ Historia Mammalium.

The Classification of the Zoological Works. prepared when Mr Children B. 2, & I were occupied by the Trustees on their Work for the Classed Catalogue of the Library

3 2

3. Musea anatomica.

9 b. Habitacula animalium.

9 ~~10~~ Calendaria Faunae:

10 Anatome animalium.

A. Respiratio.

B. Loquela.

C. Digestio.

D. Generatio

E. Monstra.

F. Motus.

G. Organa sensoria.

H. Calor.

I. Electricitas

K. Phosphorescentia

~~Veneno~~

17 ~~Animalium Venenata.~~

17 a ~~Animalia~~ Zoologia Economica

Filum & Human

~~17 b~~

~~17 c~~ ~~Physiol~~ ~~mirat~~.

21. Anatome Mammalium

A. Respiratio —

B. Loquela

C. Monstra.

The Classification of Zoological Works. A draft for a proposed classed catalogue of the British Museum Library in Gray's hand. Left hand column c. 1825, inscription top right c. 1860.

for the *Hand List of Specimens* of 1873 and subsequently (Gray, 1873). The exception is the preservation of a sheet of notes in Gray's hand attached to a list of reptiles made by Darwin on the *Beagle* (1832–1836) which came to Gray through Thomas Bell (89.f.D), one of the few links between Darwin and Gray (133).

What may be remarked upon is the fact that so many, indeed the majority of the sheets and cut-outs, laboriously built up since their compilation in the 1820s, should have remained untouched since, as if they formed a canon not to be disturbed, for one would have thought they would have received annotations over the years, even decades, unless as each catalogue was produced, it became in its turn the *Systema naturae* for each group.

Only in one case, it seems, was the illustrative material gathered between the 1820s and the 1870s rearranged for purposes of study; and this was for the *Cetacea and Sirenia.* Thus, in two volumes (bound or re-bound in 1964/65) is found anything from an eighteenth century cut-out, through a letter from Jonathan Couch, to plates of the 1860s. This, like the other manuscripts mentioned here, is preserved in the Zoological Department archives.

Acknowledgements

The writer gratefully acknowledges the facilities provided by the Department of Library Services of the British Museum (Natural History) which made the transcription of these manuscripts and the examination of Gray's drawings possible. He wishes also to record Mr M. J. Rowland's, the Chief Librarian's, help with Gray's often puzzling calligraphy, and his constant encouragement in the course of the work. Thanks are also due to Dr P. J. P. Whitehead and to Mr A. P. Harvey for numerous comments on the text, and to the latter especially for editing the large number of draft transcripts into a logical pattern.

Notes

(1) Group portrait by A. Archer, 1819. The Temporary Elgin Room, British Museum, at the British Museum (Gunther, 1975 : 38).

(2) The relations between Children and Gray at the personal as well as at official levels have been discussed in Gunther (1977).

(3) Samuel Gray IV (1694–1766) of Pall Mall, London. Seedsman and importer of plants.

(4) John Ray (1628–1705). There is no evidence to support a relationship, unless as a collateral (Raven, 1950).

(5) Carlton House, Pall Mall was built in 1788, and pulled down in 1828.

(6) Ravensbourne River, between Deptford and Lewisham.

(7) Charing Cross. In another passage (folio 55) Gray writes that the 'glass cutting part of the business was carried on by the ancestor of the present [1870] celebrated Glass Cutters at the corner of Pall Mall East'.

(8) In another text Gray gives Yorkshire. Gray visited both, but Pembrokeshire seems more likely.

(9) Dr William Hunter (1718–1783).

(10) At the Factory House in Oporto, Portugal, from 1773 to 1778.

(11) Gray resigned as Secretary at the British Museum in December 1805, but retained the other two offices until his death.

(12) Sir Humphrey Davy (1778–1829), three papers in *Phil. Trans.* 1788, 1789 and 1796 and two Croonian lectures, 1785, 1786 (Gunther, 1976).

(13) Eldest son, Francis Edward Gray (1784–1814) m. Miss Maria Emma Smith (1810) who became wife of John Edward Gray (1826); second daughter m. Taylor Combe (1774–1826); Juliana Gray, elder daughter (1775–1837), unmarried; William Herman Gray (1794 ob. inf.).

(14) The child was brought up at Charlton in Kent, the mother retiring to the neighbourhood of Greenwich on account, perhaps, of the family connections in that region.

(15) Dr Robert Nares (1753–1829), philologist, who had worked in the British Museum as Assistant Librarian, and may have got Samuel Frederick Gray work there after his return to London in 1804.

(16) Elizabeth Forfeit (1777–1852), daughter of a picture dealer in Maiden Lane, Covent Garden.

(17) The real reason for the breach, though temporary, is not known, perhaps it was because Edward Whitaker's marriage had been an unhappy one and he did not consider Samuel Frederick's health conducive to marriage.

(18) Dr Joseph Priestley (1733–1804) may have employed Samuel Frederick *before* he went to Walsall, but not in Birmingham where he worked with a Dr Black, as Assayer, of whom nothing is known.

(19) Dr Charles Hatchett F.R.S. (1765–1847), chemist and mineralogist, coach maker in Long Acre, a friend of Edward Whitaker Gray who, when Keeper in the British Museum, arranged the acceptance of the Hatchett mineral collection, the most important of that period.

(20) George Robert Gray (1808–1872) Assistant Keeper at the British Museum, ornithologist.

(21) Charlotte Frances Gray (b. 1811) m. Samuel Birch (1813–1885) Keeper of Oriental Antiquities at the British Museum.

(22) William Thomas Brande, F.R.S. (1788–1866), chemist and apothecary; successively, at Apothecaries Company, succeeded Sir Humphrey Davy at the Royal Institution, Chief Officer of Coinage at the Mint, Secretary of the Royal Society.

(23) Mr Wyatt was also employed in the Patent Repository.

(24) Mr Pratt (or Mr Prance) appears to have succeeded Francis Colombine (not Valentine) Daniell (1765–c. 1825) in the Wapping Pharmacy. Daniell, a native of King's Lynn, had practised in Wapping since 1788. He claimed to be the inventor of the Life Jacket, for which he was made a baronet and awarded the Gold Medal of the Society of Arts. *The Times* of 21 July 1806 recorded an exhibition of Daniel's Life Preserver, which supported the subject at the surface of the water. He was also the innovator of the 'Medicine Chest for Sea', provided with a proper selection of the articles required; and he wrote a treatise with practical directions for diseases common to seamen. Gray's interest in life preserving is likely to have been derived from his predecessor in the Wapping Pharmacy. (*Encyclopaedia Britannica*, *Supplement to the fourth*, *fifth and sixth editions*, vol. 6, 1824 : 361 and Gray *c*. 1862 : f. 21.)

(25) John Rennie (1761–1821), one of the great civil engineers of the period, at the time being engaged on the London and East India docks on the Thames. Buried in St Paul's, London.

(26) James Francis Stephens (1792–1852) leading entomologist of the period.

(27) Merriman, no information.

(28) Edward Granger (1797–1824) and Frederick (1791–1864).

(29) David Unwins (1780–1837) of the City and Finsbury Dispensaries.

(30) William Kingdom (d. 1863) surgeon.

(31) William Salisbury (d. 1823), author of botanical works, lectured at Maze Pond, etc.

(32) William Curtis (1746–1799), of the Society of Apothecaries; *Praefectus Horti*, and Demonstrator in Botany at the Chelsea Physic Garden, etc., author of *Flora Londoniensis*, 2 vols, 1777–1798.

(33) William Clift sen. (1775–1849) Secretary to John Hunter, physician; from 1800 Conservator of the Museum of the Royal College of Surgeons; F.R.S. 1823.

(34) William Elford Leach, M.D., F.R.S. (1790–1836), at the time 'Assistant Librarian' (later Assistant Keeper of the Natural History Collections) at the British Museum, Montagu House.

(35) Sir Joseph Banks (1743–1820) of 32 Soho Square, London. This is the only reference Gray makes to attending the famous breakfasts.

(36) Richard Anthony Salisbury (1761–1829), botanist.

(37) Augustine Pyrame de Candolle (1778–1841).

(38) M. F. Dunal (1789–1856).

(39) *Thompson's Annals*, or *Annals of Philosophy*, a reference to the paper by Gray, S. F., 'Historical Sketch of improvements in physical science', in issue of August 1820, pp. 115–130. (See Gray, 1875, item no 1).

(40) S. F. Gray under whose name *A Natural Arrangement of British Plants* (1821) was published, was the sole author of part I in volume I, the rest being John Edward's work under his guidance, helped by Samuel Forfeit, at that time working at Apothecaries Hall. (See Gray, 1875, item no 4a).

(41) Antoine Jussieu (1748–1836), *Genera plantarum*, 1774.

(42) Dr John Lindley (1799–1865), author of *Introduction to the Natural System of Botany*, 1830.

(43) William John Burchell, D.C.L. (1781–1863), explorer and naturalist. (See also note 81.)

(44) R. A. Salisbury's MSS. were edited by Gray under the title of Genera of Plants, London 1866 8vo. Salisbury's drawings are preserved in British Museum (Natural History) Botany Library, under 582.4/SAL/Q. (See Gray, 1875, item no 719).

(45) A. H. Haworth (1768–1833), a friend from the Little Chelsea days.

(46) N. A. Vigors (1785–1840), F.R.S., M.P. first Secretary of the Zoological Society 1826–1833.

(47) The President was its founder, Sir James Edward Smith (1759–1828).

(48) The Bishop of Norwich who proposed the toast was Edward Stanley (1779–1849), an amateur naturalist of distinction. The year of the anniversary dinner is unknown, but probably after Gray became Keeper in 1840. He was elected to the Linnean Society on 7 April 1857.

(49) Baron Georges Cuvier; Jean Baptiste Lamarck (1744–1829); P. A. Latreille (1762–1833).

(50) *Encyclopaedia Britannica*, Supplement 1815–1824 and Sixth Edition 1823; and *Edinburgh, Encyclopaedia*, edition of 1830, p. xii, the volumes appearing from about 1808 (Sherborn, 1937).

(51) Charles König (1774–1851), became Keeper of the Natural History Collections in 1813.

(52) House of Commons, Select Committee of 1835, 1836.

(53) 'Mr. Samuel', so written by Gray perhaps out of contempt, was George Samouelle (d. 1846) (see Gunther, 1977).

(54) Alexander MacLeay (1767–1848), Secretary of the Linnean Society.

(55) Samouelle, G. 1819. *The Entomologist's Useful Companion, or an Introduction to the Knowledge of British Insects*. London, 496 pp.

(56) James Sowerby, the elder (1757–1822) (MacDonald, 1974).

(57) *The Mechanics Weekly Journal* appears to have been sponsored partly by S. F. Gray but was suppressed by its competitors after appearing between November 1823 and May 1824.

(58) John George Children, F.R.S. (1777–1852) was appointed to succeed Dr Leach in 1821 (formally 8 March 1822).

(59) Capt. F. W. Beechey (1796–1856), in command of H.M.S. *Blossom* during voyage of 1825–1828 to circumnavigate the globe.

(60) General Edward Sabine, F.R.S. (1788–1883), later President of the Royal Society.

(61) Francois Péron (1775–1810); C. A. Le Sueur (1778–1846).

(62) Sir Henry Ellis (1777–1869), Keeper of Manuscripts, 1812–1828; Principal Librarian, (1828–1856).

(63) Gray gave evidence in July 1835 and again in April 1836.

(64) Sir Benjamin Hawes (1797–1862), Member for Lambeth, sponsored the Committee, which became known as the Hawes Committee.

(65) Although in 1836 Gray was still only as an assistant to Children at 15/- a working day, most of his recommendations were accepted by the Committee, which brought an adjustment to his salary. Not all the Committee's recommendations were, however, accepted by the Trustees.

(66) Mr 'Samouel's' [Samouelle's] case was investigated by the Committee (29 July 1835) leaving little credit to his sponsors.

(67) Sir Robert Harry Inglis (1786–1855), Conservative politician.

(68) John Edward Gray succeeded as Keeper of the Zoological Department on 11 April 1840, and retained the position for 35 years.

(69) Francis Walker (1809–1874) (Gunther, 1912: 8).

(70) E. A. Smith appointed in 1867 as a personal assistant to Dr Gray, for the Mollusca and 'Lower Animals'.

(71) Albert C. L. G. Günther, M.D., F.R.S. (1830–1914) joined the Museum in 1857 to work on fishes, and became Keeper of Zoology in 1875.

(72) This was arranged in 1862 by Albert Günther through his friends in the *Konigliches Naturalien-Kabinet* at Stuttgart.

(73) About 1870.

(74) Dr Eduard Rüppell (1794–1884) traveller and naturalist. In Abyssinia from 1830 to 1834.

(75) Admiral Sir John Harvey (1772–1837) was on the West Indian station for much of his time.

(76) The British Association met at Cheltenham in 1856, and Professor John Phillips (1800–1874) had been appointed Keeper of the Ashmolean and University Museum in 1854, and Professor of Geology from 1856; his lapse of memory is surprising. Phillips was the first professor to accept Ruskin's concept of what a natural history museum should be (Mallet, 1927 : 361–367). It would have been interesting to have had Gray's comment.

(77) Brian H. Hodgson (1800–1894) British Resident at Katmandu, Nepal (Gray, J. E. and G. R., 1846).

(78) Hugh E. Strickland (1811–1853) (Jardine, W., 1858).

(79) Before 1845, osteology was the preserve of the Royal College of Surgeons and it was Gray who suggested to Hodgson that he should make it a condition that the Trustees must accept his osteological specimens if the Museum were to have the remainder of his collection.

(80) William Henry Flower, F.R.S. (1831–1899), from 1861 Curator of the Hunterian Museum, and from 1870 Hunterian Professor at the Royal College of Surgeons; Director of the British Museum (Natural History) from 1884 to 1899.

(81) William John Burchell (see also note 43) travelled in Southern Africa 1811–1815.

(82) Major Charles Hamilton Smith (1776–1859), soldier and writer on natural history; retired to Guernsey 1820.

(83) Reference should read: Martius, C. and Piso, G. 1853. *Versuch eines Commentars über die Pflanzen in den Werken von Marcgrav* (1610–1644) *und Piso über Brasilien . . .*

(84) As this was written some fifty years after the appearance of Burchell's volumes, Gray's memory may have been at fault (Burchell, 1822–1824).

(85) Burchell was in Brazil from 1826 to 1828.

(86) Dr Rüppell returned from Abyssinia in 1834.

(87) Lord Derby's (1799–1869) collection at Knowsley Hall given to Liverpool in 1851. (See Gray, 1875, item no. 311).

(88) Prince Massena's collection of birds bought by Gray in 1846 for the Academy of Natural Sciences, Philadelphia.

(89) British Museum duplicates to Melbourne and Sydney through G. Krefft in 1860s.

(90) The Keeper of the Herbarium from 1844 to 1866 was William Henry Harvey (1811–1866), but there is now no record of a gift having been made.

(91) Dr John Macculloch, M.D., F.R.S. (1775–1835) chemist of the Board of Ordnance; minerals to Oxford, 1835.

(92) Robert McAndrew (1802–1873) collection of mollusca and marine invertebrates to Cambridge in 1873.

(93) The initiative for the formation of the Society came from Daniel Cooper, A.L.S., its first curator, and apart from the distribution of plants, it may be credited with three important works: H. C. Watson (1804–1881), *The London Catalogue of British Plants* (1844) and *Cybele Britannica* (1847–1859); and J. T. Boswell Syme (1822–1888), *English Botany*, Third Edition, 1863. The MS. of Gray's presidential address of 1836 is preserved in British Museum (Natural History) Zoological Department. MSS. 1835–1845: 45 f. unnumbered; ff. 1–11 (Gunther, 1975 : 77).

(94) Dr Hugh Falconer (1808–1865) in government service in India, Assam and Bengal and Captain (afterwards Sir) Proby T. Cautley (1802–1871) (Woodward, 1907).

(95) For Gray's sketch plans of foreign and British museums see British Museum (Natural History) Zoological Department. MSS. **45** : 1835–1845, ff. 22–34.

(96) In July 1846, Lord John Russell (1792–1878) had just been appointed Prime Minister and first Lord of the Treasury. The letter is filed in the British Museum (Natural History) Keeper's Room (Zoology): Foreign Letters, **2** : 214, 10 July 1846. Gray's hand-written draft will be found in British Museum (Natural History) Zoological Department MSS. **47** : 1844–1846, ff. 202–3.

(97) Edward Lear (1812–1888), G. C. Wallich (1815–1899) and John Gould (1804–1881).

(98) H.M.S. *Blossom*, 1825–1828; H.M.S. *Beagle*, 1832–1836; H.M.S. *Sulphur*, 1836–1842. H.M.S.s *Erebus* and *Terror*, 1839–1843.

(99) Gray is referring to his own contributions on the Mammalia (1844) and Reptiles (1845); of the work of a group of authors including Sir John Richardson (1787–1865) on Fishes (1844–1848) of *The Zoology of the Voyage of H.M.S.* ***Erebus*** *and* ***Terror*** *during 1839–43.* London, 1844–1875, 2 vols. (See Gray, 1875, item nos 277, 293).

(100) Getting into debt Salisbury was sentenced to the King's Bench prison, hence the phrase 'in the Bench' (compare Gunther, 1974 : 47 (note 39)).

(101) In his evidence on 2 June 1848 before the Royal Commission '. . . appointed to enquire into the Constitution and Management of the British Museum' (1850), para. 3346, Gray gives the years as 1814–1819, but the dates in the letter are more likely.

(102) J. J. Kaup (1803–1873), H. A. Hagen (1817–1893), T. Desvigne (1812–1868), W. S. Dallas (1824–1890), J. O. Westwood (1805–1893), T. V. Wollaston (1822–1878), G. Newport (1803–1854) also W. C. Hewitson (1806–1878) and F. Walker (1809–1874) (Günther, 1912).

(103) Antonio Panizzi (1797–1879), Principal Librarian, British Museum.

(104) See The Great Zoological Gallery, British Museum – Easter Monday, *Illus. Lond. News*, 11 October 1854 (Gunther, 1975 : 170 note 115).

(105) J. E. Gray married his cousin by marriage, Maria Emma Gray (née Smith), widow of Francis Edward Gray (1775–1814) who had purchased Eliot Vale Cottage, Blackheath. The Grays lived there until 1840 when they moved to the Keeper's Apartments in the British Museum at Bloomsbury.

(106) Either the Blackheath Mechanics Institute or the Greenwich Society for the Acquisition of Useful Knowledge.

(107) Sir John Bennett (1814–1897), Councillor of the Ward of Cheap and on London School Board; brother of William Cox Bennett (1820–1895), a minor poet, friend of Gray's, and secretary of the Greenwich Mechanics Institute.

(108) The Borough of Greenwich was enfranchised by the Reform Bill of 1832.

(109) Wicker ice-boat designed by Thomas Ritzler.

(110) Elected to the honorary office of Steward in 1851, for life.

(111) Leroy d'Etiolles (1798–1860) French surgeon of Paris. In another version Gray states that his attention was drawn to 'J. Leroy (d'Etoile's)' report by his naturalist friend, Professor A. Duméril in 1832.

(112) In 1835 the Society appointed a Medical Committee to consider the new method, and the credit appears to have been given to their surgeon, Dr John Dalrymple, see *Reports of Humane Society* for 1832–1840.

(113) The Municipal Reform Act of 1835 made it obligatory on local authorities to introduce public utilities such as water supply, sewage, gas, roads and housing.

(114) Dr John Richardson was appointed Chief Medical Officer to the new Melville Hospital at Chatham in 1828, and to the Royal Hospital at Haslar in 1838. In 1839 Dr John Conolly (1794–1866), a pioneer in the humane treatment of lunatics, was appointed to Hanwell.

(115) Sir Rowland Hill (1795–1879) on *Post Office Reform*, Reports 1837–1864.

(116) Known as the Mulready envelope.

(117) Gray, J. E., *A Hand Catalogue of Postage Stamps for the Use of Collectors*, London, Robert Hardwicke. 1862.

(118) *The Times*, 23 August 1853, which was followed in the next four years by some 30 letters and articles to various periodicals.

(119) There were many Select Committees and Royal Commissions on the question of decimal coinage from the 1820s onwards, but here Gray refers to the Reports of the Decimal Coinage Commissioners of 1856–1857 and to its Final Report of 1859, with appendices.

(120) Thomas Graham, F.R.S. (1805–1869), chemist, master of the Mint, 1855–1869.

(121) W. T. Brande, F.R.S. (1788–1866), mentioned previously, was at the time Chief Officer of Coinage at the Mint.

(122) Jeremiah Joyce (1763–1816), *Scientific Dialogues*, London 1809, 7 vols.

(123) Zerah Colburn (1804–1839), American mathematician prodigy.

(124) George Bidder (1806–1878), engineer.

(125) It was Gray's complaint that he never received the Royal Society's Gold Medal. For him to join a Dining Club was 'to do that nothing thing'.

(126) Gray could have cited, as an example, an almost exact contemporary (possibly a collateral), namely John Gray (1802–1888) born at Dudley, the second son of Thomas Gray, linen draper of High Street, Dudley. John Gray was a geologist of considerable local distinction, being one of the founders of the Dudley and Midland Geological Society and an honorary member of the Swedish Geological Society. Although there is no known connection between the two Grays, who must have known one another, John Gray of Dudley (and after 1850 of Hagley) seems to have shared the family characteristics. He was an avid collector, an evangelical churchman and ardent reformer (see obituary, in *Stourbridge Express*, 21 July 1888, p. 5; and also Woodward, 1907 : 164).

(127) William Sharpey F.R.S., (1802–1880), Professor of Anatomy and Physiology, University College, London 1836–1874.

(128) Novelists are not always, perhaps, the most truthful of writers. In 1861, a young man of 17, Arthur O'Shaughnessey, a 'nephew' of Lord Lytton, novelist and M.P., joined the staff of the Museum, much to the vexation of those for whom he worked, including Dr Gray. After one of the many incidents that came to the attention of the authorities, O'Shaughnessey, explaining matters to his Lordship, wrote:

> 'With regard to Dr. Gray, no opportunity is likely to occur of propitiating him, & I know by many experiences what the result would be. If I had to deal with an ordinary human being, such an interview, with the confidence and security that your words would inspire in me, could not fail of success: but Dr. Gray is impervious to such words as a wild beast in his den. He would not even hear one of them, as from the very first he has always stopped me with a savage unintelligible splutter of his own. He has a way of gnashing his teeth at me that would quite frighten even you My Lord! I always treat him with the utmost respect . . .' (Paden, 1964 : 24).

(129) Major General Thomas Hardwicke (1756–1835), of the East India Company, retired in 1823.

(130) Gray, J. E. 1830–1835. *Illustrations of Indian Zoology*. London. 2 vols. (See Gray, 1875, item no. 70).

(131) The Moravian Bretheren, so called, linked to the Lutheran Church.

(132) A member of the Broadwood family whose firm of piano manufacturers, founded in the eighteenth century, was flourishing in Gray's day, as it still is.

(133) The one outstanding collaboration between Gray and Darwin is recorded by A. E. Gunther (1979).

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Sandra Herbert is Associate Professor in History at the University of Maryland Baltimore County and is the author of several studies of various aspects of the early career of Charles Darwin.

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An Irish naturalist in Cuvier's laboratory. The letters of Joseph Pentland 1820–1832

William A. S. Sarjeant & Justin B. Delair

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An Irish naturalist in Cuvier's laboratory. The letters of Joseph Pentland 1820–1832

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With an Introduction and Notes by William A. S. Sarjeant and Justin B. Delair

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Introduction

The figure of Georges Cuvier,[1] Professor of Anatomy at the Jardin du Roi in Paris for almost exactly 30 years, looms large in the history of zoology and geology. Cuvier was a great anatomist, indeed perhaps the first great comparative anatomist; he was the first to describe a host of living and fossil vertebrate species, the first to attempt the reconstruction of extinct vertebrates from their skeletal remains, and the first to attempt to predict the character of missing bones from an incomplete skeleton. The theory he formulated to account for extinctions, that the Earth had suffered a series of 'revolutions' or catastrophes each involving the annihilation of the entire animal faunas (or the greater part of them) bulked large in the thinking of geologists during the early part of the nineteenth century. In consequence, Cuvier has received a great deal of attention from historians of science. Many of his letters have been published (Silbermann, 1833; Marchant, 1858; Viénot, 1905), and a series of biographies of very variable quality have been written about him (Duvernoy, 1833; Lee, 1833; Anon [Parker], 1844; Flourens 1858, 1861; Demoulin, 1881; Blainville, 1890; Hamy, 1906; Roule, 1926; Daudin, 1926; Viénot, 1932; Coleman, 1964; Anon, 1970*b*; Ardouin, 1970), as well as many shorter articles (e.g., Anon, 1970*a*). In addition, Cuvier and his ideas are discussed in all major histories of biology and geology and even figure in many works on philosophy.

Strangely enough, however, the fact that Cuvier had, for a number of years, a British assistant has consistently escaped attention. Joseph Pentland worked more or less continuously with Cuvier between 1818 and 1822 (and perhaps later), becoming a trusted and valued associate; he was working in Paris at the time of Cuvier's death on 13 May 1832, and he prepared a posthumous catalogue of Cuvier's collections (Pentland, 1832), which survives in the library of the Institut de France. It is clear that he acted as liaison between Cuvier and English scientists and that he not only arranged the shipment of casts and specimens from Paris to museums in Britain, but also procured many specimens for the museum of the Jardin du Roi (now the Jardin des Plantes). He also aided Cuvier in dissections and in the preparation of descriptions of newly discovered animals, living and fossil, and acted as cicerone for English-speaking visitors to Cuvier's laboratory. Despite all this activity, his name does not figure in any of the biographies of the great French scientist and the former existence of this connecting link between British and French science has been forgotten.

In 1970 a series of letters by Pentland, written to the great English geologist William Buckland (1784–1856), was advertised for sale by the bookseller Anthony D. Lilly of Hythe, Kent. An immediate telephone inquiry resulted in their being sent for examination to one of us (W.A.S.S.); their interest was immediately apparent. As a consequence of the intercession of Professor the Lord Energlyn of Caerphilly, the letters were purchased by the Library Committee of the University of Nottingham, in whose Manuscripts Collection they are now lodged, and were made available for transcription. Subsequently (April, 1972) two letters from Pentland to Buckland were discovered in the collection of Dr and Mrs Victor A. Eyles of Great Rissington,

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Gloucestershire.[2] Two further letters, one written to Pentland by an English lawyer and one written by Pentland to Cuvier, were located in the archives of the Institut de France; and four other letters, three written to and one by Pentland whilst he was in Paris at a much later date, were found in the National Library of Scotland and the archives of the University of St Andrews. All these letters are published in full in this paper.

Three letters from Pentland to the English geologist Thomas Webster have previously been published (Challinor, 1961), as has part of a letter to the Irish assyriologist Edward Hincks (Davidson, 1933 : 99); in neither instance was any biographical information about Pentland furnished. Unpublished letters by Pentland are contained in the collections of the Royal Botanic Gardens, Kew, the Owen Collection in the General Library of the British Museum (Natural History), the Royal Geographical Society, the library of the University of St Andrews, and the Archivo Nacional de Bolivia, La Paz. It is hoped, in the future, to transcribe and publish these letters also; they all date from later periods in Pentland's life.

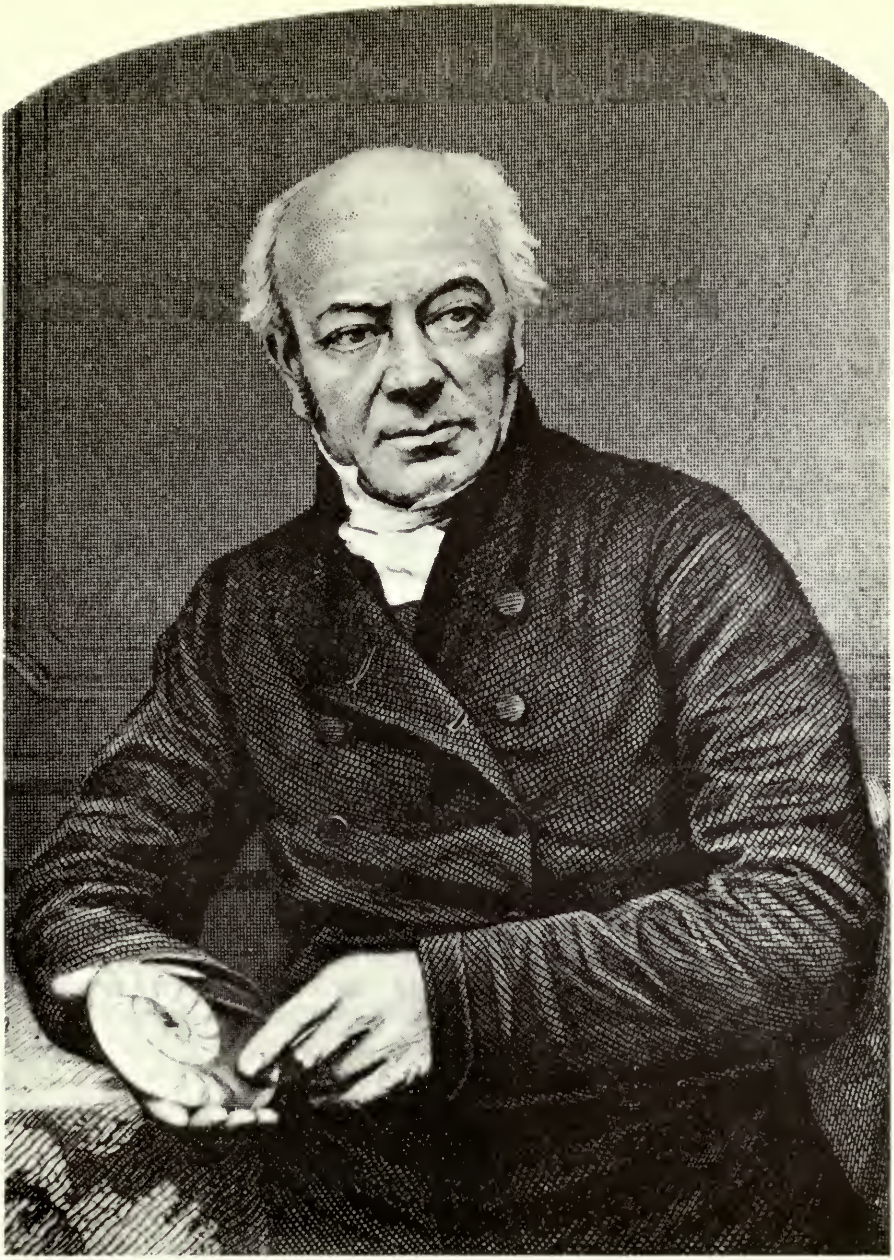
Joseph Pentland: a biography

This biography is based on the obituary notice in *The Athenaeum* (Anonymous, 1873), the Pentland entry in the *Dictionary of National Biography*, (B[oase] G.C., 1895) and on details given in the letters published here. In addition, the addresses from which his later letters were written have been used in determining his later movements.

Joseph Barclay Pentland was born at Ballybofey, County Donegal, Ireland, on 17 January 1797 and was early left an orphan;[3] from the letters, however, it is clear that relatives took him under their wing and continued to finance his studies and investigations for many years. He was educated at Armagh Academy and thereafter at the University of Paris; in his letters, he notes that he began studying mineralogy and crystallography under Haüy,[92] and chemistry under Gay-Lussac[98] and Thénard,[100] working for 12 months with the latter (see p. 273). He then went on to study geology at the Ecole des Mines, under the guidance of Cordier,[101] Brochant de Villiers[84] and the elder Brongniart[56], afterwards undertaking an extensive geological tour in central and southern France in which he travelled 'near 2500 English miles' (p. 273). On the basis of the rocks he saw and the fossils he found, he developed 'a decided taste for Geology' (*idem*) but concluded that a sound knowledge of zoology was essential to a palaeontologist; accordingly, on his return to Paris, he commenced studying with Cuvier, probably around 1818. By 1820, when the correspondence documented here begins, he had progressed to the point where he was ranked, not just as Cuvier's assistant, but also as his friend and confidant.

His principal correspondent, William Buckland, was perhaps the most distinguished scientific polymath of the Victorian period. After taking Holy Orders in 1809, he engaged almost wholly in geology during the ensuing decade, making extensive field tours; in consequence, he was appointed Reader in Mineralogy at the University of Oxford in 1813 and was made its first Professor of Geology in 1819. He was one of the original 13 founder members of the Geological Society of London and was its President at the time it gained its royal charter in 1824, serving for a second term in 1840. He was the first Honorary Member of the (later Royal) Agricultural Society and the second President (in 1832) of the British Association for the Advancement of Science. Among his many other scientific distinctions were Honorary Membership of the Royal Society of British Architects and of the Institution of Civil Engineers. In addition to his work in geology and the associated sciences of palaeontology and spelaeology, Buckland investigated land drainage systems and pioneered the use of mineral fertilizers in agriculture, undertook work in pisciculture and archaeology and studied the ecology of land snails. In 1845 he became Dean of Westminster and, during his tenure of this appointment, not only undertook restoration work in the Abbey and reorganized the choir school but also successfully redesigned part of London's sewage system! Even by 1820, Buckland had already attained prominence in English science; he had indeed been elected Fellow of the Royal Society as early as 1818 (he served as its Vice-President from 1832–1833). Unquestionably Buckland was a most useful friend for a young naturalist to have.

How Pentland came to be friendly with Buckland is not clear. They certainly met when



William Buckland holding an ammonite; from an engraving.

Buckland visited Paris during June, 1820, since, in a letter to the geologist Thomas Webster[4] on the 19 June of that year (Challinor, 1961 : 182), Pentland wrote:

> Mr Buckland has passed 6 days here on his way to Auvergne; he has perfectly cleared up every point relative to the formations between chalk and Transition formation, he is held here in a very high point of view. I assure you when I spoke to him of yr. paper on the Isle of Wight, he told me that it was one of the best in the collection of yr. Transactions. . . .

Buckland's account (Gordon, 1894 : 37–39) of his dinner with Cuvier on this visit contains no mention of Pentland; perhaps the latter was not present, perhaps he was not important enough to warrant mention. More surprising is the fact that Pentland did not meet Conybeare, who was Buckland's companion on this Continental tour.

William Daniel Conybeare (1787–1857) was Buckland's close friend and a fellow cleric, as well as an enthusiastic and competent geologist who travelled widely with Buckland on geological tours and whose work on fossil reptiles is extensively discussed in these letters.

Pentland had apparently met Webster on a brief visit to England earlier in the same year, since a letter introducing him to Webster survives. The letter was written by another Englishman, Thomas Richard Underwood (*c.* 1765–1836). Underwood was a talented artist, who had exhibited a total of 23 landscapes at the Royal Academy between 1789 and 1801. He had lived in Paris since the time of the Treaty of Amiens (March, 1802), at first as a prisoner on parole; later he attracted the favour of the Empress Josephine and thereafter enjoyed the freedom of Paris. He seems to have been a dilettante of mercurial temperament and has been described as 'an acquaintance of Coleridge's, a friend of Fuseli's, an antiquary, but ardent for the latest fashion in politics and morals; a flaming democrat and an admirer of Napoleon' (Treneer, 1963 : 79). He is principally remembered for his association with Sir Humphry Davy (1779–1829), the great chemist, and figures in most biographies of that scientist. John Davy (1836, **1** : 147), said he was 'an artist of some talent, with a fondness for science, from whom Dr Paris [Davy's earliest biographer] seems to have received many unfavourable notices of my brother, incidents and anecdotes which, even if true, no true friend would have communicated of another' and also noted that Sir Humphry 'ceased to esteem Mr Underwood in the latter part of his life.' (Davy 1836, **1** : 50). Challinor, in his commentary on Underwood's letters to Thomas Webster, commented that 'It would no doubt have been better for Webster if Underwood had not sided with him so ardently and inflamed his grievances, real or imaginary, with, at times, such violent expressions' (Challinor, 1961 : 182). This very violence of expression is evident in Underwood's references to Pentland; though he had originally introduced Pentland to Webster as 'a particular friend of mine' (Challinor, 1961 : 184) he later says in a letter written in December 1821:

> . . . if what I have done furthers your truly scientific inquiry and will assist you to defeat a band of busy, jealous, active & revengeful witlings, do not fear I will relax my exertions. They have gained and kept their ascendancy partly from the contempt, partly from the indolence of others, and they think that the forebearance of men of science has arisen from want of power to do justice to themselves or to make reprisals in the quarters of their enemies. This band has an active agent here but he begins now to be pretty well known, and has long been suspected, I mean that lying thief (I mean what I write) Pentland, who is in constant correspondence with Buckland & Conybeare, to who he communicates all he can pick up at Cuvier's (Challinor, 1961 : 193).

Though Pentland himself wrote relatively little about Underwood, his mentions of the latter suggest mixed feelings, at very least; certainly it is clear that he did not view Underwood with unalloyed esteem. As will be seen, Pentland's letters to Buckland contain nothing that gives credence to Underwood's unpleasant imputations.

From the date of his first letter to Buckland (June 1820) until March 1822 (when he set off with a friend on a tour into Italy), Pentland remained continuously in France; though visits to England were repeatedly contemplated (see pp. 272 & 276), none was made. During this time, he was beginning to try to establish himself in a career; he was offered the post of Assistant Surgeon with the Honorable East India Company, but ultimately declined it (p. 289) and he also investigated the possibility of a post in New Holland (Australia) (p. 277), but did not follow this up. Several letters refer to his interest in an appointment as naturalist at the British Museum but, though he wrote at length to Buckland about this as early as 3 December 1821, unsuccessfully soliciting his support (pp. 285, 288–9) and later registering indignation when it was not forthcoming (p. 290), Pentland was curiously dilatory about actually submitting a formal application and had not done so even by March 1822. Indeed, we have found no evidence that he ever *did* submit an application. Perhaps for this reason (for Pentland was certainly extremely well qualified for the British Museum appointment and Cuvier's endorsement of his candidature should have carried great weight), he did not obtain the post and was again working with Cuvier when the last letter of the main sequence was written, in February 1824. An offer of an appointment by the Russian Government had in the meantime been declined on patriotic grounds (p. 272), a decision which Pentland may well have regretted when no British appointment was forthcoming.

Pentland was, at this time, still apparently being supported by his relatives, since he had to seek their approval before going to Italy (p. 294). They seem to have considered his activities not altogether respectable; this is surely the only reasonable explanation for his unwillingness to be referred to in Conybeare's work on ichthyosaurs (p. 274), which in turn accounts for the fact that his significance in the early studies of fossil reptiles has hitherto passed unrealized (see Delair & Sarjeant, 1975). The financial support he was receiving seems to have been ample, since he observed, with slight disdain, of another young naturalist that he was 'poor as a Church Mouse' (p. 286). There is no indication that he was receiving any salary for his work for Cuvier; the fact that he worked so long and so hard[5] therefore indicates the profundity of his interest in natural history and the excitement he felt about the work he was doing.

Although he apparently did not return to England during the period covered by these letters, Pentland was not continuously in Paris; he mentions having travelled, on a bone-quest, to Nice and Ceuta in the Winter of 1820 (p. 284) and his plans for an extensive tour in Switzerland and Italy in 1822 are discussed at length (pp. 293 & 296). Whilst on this tour, he must have written several times to Buckland and to Cuvier. A single letter written to Cuvier from Florence (pp. 297 & 300) has been located; it shows the vigour with which Pentland was prosecuting his osteological researches on his mentor's behalf. Since Buckland quoted Pentland as the source for the data on the Val d'Arno and on the mammalian fossils in Florence museum quoted in *Reliquiae diluvianae* (1823 : 26, 182), it is clear that his correspondence with Pentland continued after the date of the last letter here transcribed; only one later letter, dated 28 February 1824, has been located. In this last letter (p. 304), Pentland outlined plans for a brief visit to England and a lengthy winter stay (1824–25) in Sicily; evidently he was already acquiring the strong affection for Italy which was to be a major factor in his later life.

Pentland's letter reports his discovery of an almost complete bear's skull in the Florence museum. This find, and its significance, were discussed in the notebooks of the pioneer spelaeologist Father John MacEnery:[6]

> 2 fragments of anomalous species of Bear were found in Tuscany which Cuvier provisionally named as the Etruscan Bear — but the researches of Mr Pentland an English naturalist of great eminence led to the discovery of an entire head in the museum of Florence which has been raised from the bed of the Val d'Arno and determined the species of the Etruscan Bear— by degrees it began to reveal itself and an analogous tooth to those *previously* found in this cavern[7] was discovered in the cave of Lunei near Montpelier. The resemblance of the tusk to a blade made Cuvier change the local name of Etruscan to the more general and characteristic appellation of cultridens[8] . . . (Alexander, 1964 : 132, 133).

Perhaps during his visit to England in 1824, perhaps during 1825 or 1826, Pentland had the opportunity to study some mammalian remains from north-east Bengal and to examine rocks from India in the Geological Society's museum. The results of this work, conveyed in the form of a letter to the English geologist W. H. Fitton[9], were presented to the Geological Society on the 2 May 1828. The discovery of a new species of *Anthracotherium*, *A. silistrense*, was reported, but no figures were provided (Pentland, 1828). He was also engaged at about this time in a detailed examination of fossil fishes from the sediments of Caithness later shown to be of Devonian date, which had been sent to Cuvier for examination and passed by him to his assistants. Pentland's work on these was acknowledged and quoted in a joint paper on those strata by Sedgwick and Murchison, read to the Geological Society of London on 16 May and 6 June 1828.

Before this, Pentland had at long last found the means of fulfilling his desire to travel to distant lands. In 1826–1827, he travelled to South America with Woodbine Parish[10] on an exploratory expedition to the Bolivian Andes, an area previously little visited by Europeans. His geographical and geological discoveries were of great importance. He took extensive observations on the position of the snowline, discovering the mean position of the permanent snowline to be 16,990 ft (5100 m). He was also the first to recognize the height of the Bolivian Andes, finding the mean height of the practicable passes, even, to exceed 14,650 ft (4400 m) and determining the altitude of the major peaks—Gualtieri (22,000 ft, 6600 m,) Arequipa (18,300 ft, 5490 m), Chirquibamba (21,000 ft, 6300 m), Illimani (21,300 ft, 6390 m) and Sorata (24,800 ft, 7440 m) (Pentland, 1835, 1838; Arago, 1830). (These measurements have since been corrected: Mt. Arequipa, now known as El Misti, to 19,110 ft [5733 m], Illimani (Bolivia) to 21,184 ft [6355 m] and the higher of the two peaks of Sorata to only 21,490 ft [6447 m].). He noted that the majority of the peaks were volcanoes, extinct or dormant, but that sedimentary rocks were also present at great altitudes; for he found Silurian fossils at 17,000 ft (5100 m) and a Carboniferous limestone at 14,000 ft (4200 m). He visited Lake Titicaca, noting that the Rio Desaguadera was its outlet (all earlier maps show this river running *into* the lake).

As a result of this journey, he secured his first diplomatic appointment, as secretary to the Consulate-General in Peru (1827). His tenure of this appointment was, however, quite brief; and by early 1828 he was back in Europe. The course of his researches during that year can be traced unusually fully, from two accounts in the *Transactions of the Geological Society of London*. In May 1828, W. H. Fitton[11] read to the Society a letter from Pentland, reporting on the studies that Pentland had made of bones in the Society's Museum. These were from Cooch-Behar, India, and constituted the first fossil mammalia to be brought back from south-east Asia. Pentland noted that they comprised:

> 1. One species of the genus *Anthracotherium* of Cuvier. 2. A small species of Ruminant allied to the genus *Moschus* [the musk-deer], 3. A small species of herbivorous mammal referable to the order Pachydermata, but more diminutive than any of the fossil or living species; and 4. A carnivorous animal of the genus *Viverra* [the civet].

Pentland was by that time back in Paris; and soon afterwards he was engaged in examining some fishes from the Old Red Sandstone of Caithness, Scotland, sent to Cuvier for study by the distinguished geologists Sedgwick[12] and Murchison[13]. Pentland almost certainly helped prepare the drawings and descriptions of, and may even have chosen the names for, the new species described in the accounts given to the Geological Society on 16 May and 6 June of that year; if so, a continuing desire for self-effacement may again have prevented him from taking more explicit credit for his work (Sedgwick and Murchison [1828], 1835).

A letter from Paris in July 1829 (Challinor, 1963 : 293) attests to Pentland's continuing residence in that city; and in 1830, the surgeon and palaeontologist Gideon Algernon Mantell (1790–1852) noted in his journal:

> March 20 . . . Mr Pentland writes me from Paris that Baron Cuvier has presented to him for me a cast of the celebrated head of the Mosasaurus that Hoffman found, the Canon stole, and the French revolutionary army plundered and sent to Paris where it still remains—the glory of the Organic Rem^{s} [Remains] of a former world, as poor Parkinson[14] has it. What a noble addition this will make to my museum.
> May 1 . . . Sent a box of fossils to Mr Pentland by the steam-packet; and papers to Baron Cuvier, M. Prevost,[125] Brongniart[56] etc. (Curwen, 1940 : 75, 77)

On 17 February 1830, an account of the geology and fossils of the Hunter's River district of New South Wales was presented to the Geological Society of London (Cunningham [1831] : 255–256). A series of bones from a calcareous breccia cropping out in this region was at about this time presented to Cuvier for examination; they had been collected by Major Mitchell,[15] then Deputy Surveyor-General for the colony of New South Wales, and were transported to Paris by Professor Jameson of Edinburgh.[16] Pentland reported on them to the newly formed Société Géologique de France at a meeting later in 1830. Eight species of vertebrates were considered to be represented: seven of them, reasonably enough, were marsupials, attributed to the genera

Hypseprunus, *Thylacinus*, *Macropus*, *Halmaturus* and *Phlaeomys*, but the eighth, thought to be a species of elephant or mastodon and represented only by an incomplete femur, appeared surprising then and seems quite incredible now! (It may well have been an incomplete femur of the then unknown giant marsupial *Diprotodon*). Pentland noted that, with this single exception, the skeletal remains confirmed Cuvier's law that 'in each continent all the extinct species of mammals belong exclusively to genera still existing on these continents' (transl.) (Pentland, 1830). Pentland gave an account of the collection in a letter to Jameson written on 22 April 1831; when this was published, however, it was erroneously credited to Mitchell (Pentland, 1831). A fuller account of the discovery was published in 1832, when the bones were returned to Scotland and deposited in the Edinburgh College Museum (Pentland, 1832).

A mention in a letter to Gideon Mantell, 10 October 1830 (Lyell, 1881, **1** : 288), by the eminent geologist Charles Lyell[17] indicates that Pentland was in Paris in October 1830. Indeed, since Pentland wrote to Jameson from Paris in April 1831, was certainly there in August of the same year (see p. 306) and was there at the time of Cuvier's death on 13 May 1832, it is clear that he was working pretty continuously at the laboratories in the Jardin du Roi during these years. The osseous remains from New South Wales continued to engage his attention during this period; Mitchell had sent a further collection directly to Cuvier. An account of them was sent for publication to Jameson on 15 November 1832; once again, however, the authorship was wrongly accredited, this time to a mythical 'William Pentland' (Pentland, 1833). (As a consequence, the authorship not only of this paper, but also of two others in which Pentland's initials were not given, was erroneously attributed to 'William Pentland' in the Royal Society's list of publications and elsewhere, e.g. Simpson (1930 : 26) where the 'Major Mitchell' note is incorrectly attributed to 'W. Pentland'. After the death of his mentor, Pentland's preparation of the posthumous catalogue of Cuvier's great collection (see p. 245) brought his activities at the Jardin du Roi to a fitting close.

Pentland's extensive Italian collections, now lodged in the Jardin du Roi, had not been fully described by Cuvier, nor did Pentland himself do more than merely catalogue them. Other palaeontologists regularly visited Paris to study the collections; among them was a German, Hermann von Meyer[18], who devoted particular attention to a collection of 100 bones obtained by Pentland from the ossiferous Grotta dei Beni Fratelli in Mt Beliemi, 4 miles (6½ km) west of Palermo, Sicily. Meyer found that the greatest proportion of the bones—seven-tenths of them—were those of a hitherto undescribed species of pygmy hippopotamus, 'scarcely larger than our large domestic ox' (Meyer, 1832 : 533). This species was unrepresented in the collections from mainland Italy and remains so; it was an island species, whose remains were subsequently discovered also in Crete and Malta. Meyer named it *Hippopotamus pentlandi*.

Pentland continued to reside in Paris, and presumably to work at the Jardin du Roi, during the ensuing few years; however, he travelled to Scotland to present an account of the osteology of the ancient inhabitants of the Andes at the British Association meeting in Edinburgh in 1834 (Pentland, 1835). He was again in Paris in June, 1836, but shortly thereafter was appointed by Lord Palmerston to be Consul-General in Bolivia from 1 August 1836, holding this appointment till 1839 and residing for most of this period in La Paz[19]. During 1838, he made a tour in the southern provinces of Peru and visited Cuzco and neighbouring localities of archaeological interest (Pentland, 1838); also during this second South American residence, he made a complete survey of Lake Titicaca, a formidable task in view of its size. (Pentland's map of the lake was engraved and published by the Admiralty in 1847).

Pentland's subsequent movements have, as yet, been only partially determined; the transcription of his later correspondence will undoubtedly clarify his movements and concerns to some degree but (since the letters only occasionally bear addresses) it is doubtful whether a detailed biographical account of his later years can ever be written. There seems no evidence that he ever again sought regular employment and it is to be presumed that he now had private resources adequate for his needs. His life continued for some years to be peripatetic. He was in Paris in 1839, probably in 1841, in 1847 and in 1848, but there is no indication of any resumption of work in the Jardin du Roi. From 1845, he made Rome his winter residence and travelled extensively in Italy, becoming indeed so well acquainted with Italian topography and antiquities that he edited for the publisher John Murray three editions of a handbook to Rome and editions of handbooks to northern and southern Italy (Pentland, 1860, etc.). Another consequence was that he was asked to act as guide to the Prince of Wales, afterwards King Edward VII, on the latter's two visits to the city; according to Pentland's obituary in the *Athenaeum* (Anonymous, 1873), 'from him and Princess, Mr Pentland received the greatest kindness and consideration until the day of his death'. Among his other visitors there was Sir Archibald Geikie,[20] who journeyed to Rome in 1870, 'the year of the great Oecumenical Council', when 'the streets were crowded with cardinals, archbishops, bishops, abbots . . . gathered together from every corner of the globe'. In consequence, 'Although much tempted to linger here for a while, I had to content myself with a stay of only two or three days, during which, thanks to Mr Pentland, at that time the great resident English authority on Rome (to whom Murchison had given me an introduction), I saw the chief pagan antiquities . . .' (Geikie, 1924 : 135).

Pentland did little further work in vertebrate palaeontology, publishing only one more paper on this topic (Pentland, 1858). However, further bones he had collected from the Sicilian cave deposits were described by the eminent English vertebrate palaeontologist Hugh Falconer[21]; among them, appropriately enough, were numerous remains of *Hippopotamus pentlandi* (Falconer, 1860). Falconer's own collection, lodged after his death in the British Museum (Natural History) by his executor, contains many bones of this species (Lydekker, 1885 : 287–291). Pentland's name was also immortalized by Ours Pierre A. P. Dufrénoy (1856, **2** : 549–55), who, named the mineral Pentlandite after him. In Dufrénoy's words: 'On a récemment decouvert à Craignûre, a neuf milles au sud-ouest d'Inverary, dans le comté d'Argyle en Écosse, une pyrite qui contient une proportion assez forte de nickel. Cette variété de pyrite, qui fournit un minerai nouveau de nickel, a été dédiée au savant M. Pentland, qui l'a fait connaître . . .'

Pentland's London residence was the Union Club in Trafalgar Square. Perhaps as an eventual consequence of the fossil fishes sent to Paris some 14 years earlier, Pentland had by now become a close friend of Sir Roderick Murchison[13]; Mantell's journal for 1842 notes:

> June 15—Attended the meeting of the Geological Society; an angry discussion between Owen and Dr Grant on the Mastodon and Tetracaulodon remains now exhibiting in the Egyptian Hall, Piccadilly by a Mr Kosch. Gossiped with Dr Buckland, Grant,[22] Lord Enniskillen,[23] Sir P. G. Egerton,[24] Mr Greenough,[25] Murchison, Pentland, Featherstonhaugh[26] etc– (Curwen, 1940 : 159).

and the diary of another geologist, Ramsay,[27] notes:

> 18th February [1849]. Sir Roderick Murchison's dinner at seven . . . Sedgwick was there, Pentland, and Lockhart, Sir Walter's son-in-law . . . We had a capital evening . . . (Geikie, 1895 : 146).

Thus it is evident that Pentland was a sufficiently familiar figure in the scientific life of the city for his presence to evoke no comment; it is equally clear, however, that he was not prominent enough to be thought worthy of anything more than incidental mention! For this reason, perhaps, he is nowhere mentioned in the lengthy biography of Murchison (Geikie, 1875), even though (according to an obituary notice) he and Murchison were indeed close friends.

In general, Pentland is an elusive figure; we have been unable to find a surviving portrait of him and his later life seems likely to remain forever obscure. He seems never to have married, nor did he apparently ever revisit Ireland, the country of his birth. Presumably because of family connections, he was periodically a guest at various English country houses; an undated letter, apparently written before 1849, was addressed from Lilford Hall, near Oundle, Northamptonshire[28] and two letters were addressed in February, 1849, from Claverton Manor, near Bath, Somerset.[29] (Many of his later letters bear neither address nor postmark).

Though he apparently did not revisit it, South America continued to figure amongst his interests in these later years; he was concerned in the production of at least two geographical works dealing with that subcontinent.[30] Otherwise, his time and interest appears to have been divided between

Italy and London. He died at 3 Motcomb Street, London, on 12 July 1873 and was buried in Brompton Cemetery, quite close to the grave of his friend Murchison.

Cuvier and his laboratory in 1820–1822

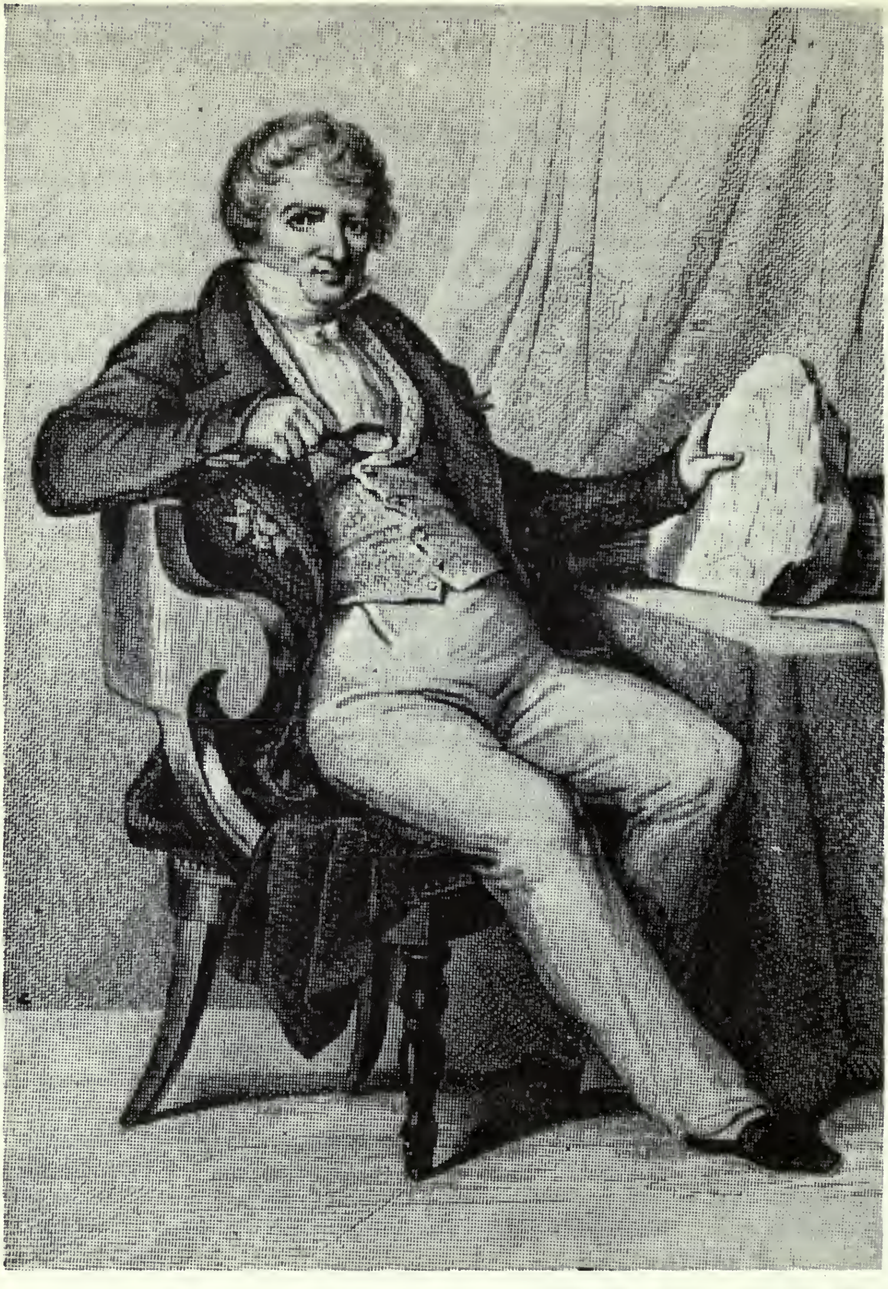
At the time Pentland was working with him, Cuvier had already attained an international reputation. His greatest work, *Recherches sur les ossemens fossiles où l'on établit les caractères des plusieurs animaux dont les révolutions du Glôbe ont détruit les espèces*, whose publication in 1812 marks the effective commencement of vertebrate palaeontology, was in course of being greatly expanded and revised, the 'second' edition being published between 1821 and 1824. (Pentland's letters refer repeatedly to the progress of this work). The excavation of the gypsum quarries of Montmartre (whose site, later to be covered by cheap housing as Paris grew, was to become a focus for artists) was yielding a rich supply of Tertiary mammalian remains; the skeletons often were so incomplete and so intricately mixed with other bones that Cuvier's anatomical ingenuity must have been repeatedly taxed in deciding what went with what.

The absence of human remains was an especially striking feature of these deposits, so far as contemporary zoologists and geologists were concerned. Cuvier himself believed that the history of life had gone through three distinct past epochs—ages of invertebrates and fishes, of reptiles, and of mammals, each terminated by a world catastrophe—and that man did not appear till the fourth epoch. His ideas, originally expressed in a preliminary discourse to the first edition of *Ossemens fossiles*, had been published separately in an English translation (Cuvier, 1817) and profoundly influenced the geological thinking of his contemporaries; that Pentland was a whole-hearted believer in these ideas is apparent (pp. 263–264).

Cuvier's working environment is well described, at a slightly later period (it had probably changed little since Pentland's time) by Charles Lyell:

> I got into Cuvier's sanctum sanctorum yesterday and it is truly characteristic of the man. In every part it displays that extraordinary power of methodising which is the grand secret of the prodigious feats which he performs annually without appearing to give himself the least trouble. But before I introduce you to this study, I should like to tell you that there is first the museum of natural history opposite his house, and admirably arranged by himself, then the anatomy museum connected with his dwelling. In the latter is a library disposed in a suite of rooms, each containing works on one subject. There is one where there are all the works on ornithology, in another room all on ichthyology, in another osteology, in another *law* books! etc. etc. When he is engaged in such works as require continual reference to a variety of authors, he has a stove shifted into one of these rooms, in which everything on that subject is systematically arranged, so that in the same work he often takes the round of many apartments. But the ordinary studio contains no bookshelves. It is a longish room, comfortably furnished, lighted from above, and furnished with eleven desks to stand to, and two low tables, like a public office for so many clerks. But all is for the one man, who multiplies himself as author, and admitting no one into this room, moves as he finds necessary, or as the fancy inclines him, from one occupation to another. Each desk is furnished with a complete establishment of inkstand, pens, &c, pins to pin MSS together, the works immediately in reading, and the MS in hand, and on shelves behind all the MSS of the same work. There is a separate bell to several desks. The low tables are to sit to when he is tired. The collaborateurs are not numerous, but are chosen well. They save him every mechanical labour, find references &c., are rarely admitted to the study,[31] receive orders, and speak not . . . I found that the man who makes moulds,[32] and the *painter* of them, had distinct apartments, so that there was no confusion, and the despatch with which all was executed was admirable. It cost Cuvier a word only. (Lyell, 1881, **1** : 248–251).

Cuvier had by now attained the unquestioned position of foremost anatomist and zoologist



Cuvier, here seen holding a slab showing the impression of a fossil fish. Engraving by Chollet, after Giraud. Photograph: Roger Viollet. (Reproduced by courtesy of Expansion Scientifique Française, Paris and M. Paul Ardouin).

in Europe; in consequence, his laboratory was a focus for visitors and his dinner-parties and Saturday-evening *soirées*:

> . . . were the most brilliant and interesting meetings in Paris. There passed in review the learned and the talented, of every nation, of every age, and of each sex; all systems, all opinions were received; the more numerous the circle, the more delighted was the master of

> the house to mingle in it, encouraging, amusing, welcoming everybody, paying the utmost respect to those really worthy of distinction, drawing forth the young and bashful, and striving to make all appreciated according to their deserts. Nothing was banished from this circle but envy, jealousy, and scandal; and this saloon might be compared to all Europe. It was at once to see intellect in all its splendour; and the stranger was astonished to find himself conversing, without restraint, without ceremony, with or in the presence of the leading stars of Europe: princes, peers, diplomatists, and the worthy savant himself, now receiving these, and now the young students, from the fifth pair of stairs in a neighbouring hotel, with equal urbanity. No matter for him in which way they had directed their talents; what was their fortune—what was their family; and wholly free from national jealousy, he alike respected all that were worthy of admiration. He asked questions from a desire to gain information, as if he too were a student; he was delighted when he found a Scotchman who spoke Celtic: he questioned all concerning their national institutions and customs; he asked the traveller an infinity of things, well knowing to what part of the world he had directed his steps and seeming to think that everyone was born to afford instruction in one way or other, he elicited information from the humblest individual, who was frequently astonished at his interest in what seemed so familiar to himself. One thing used particularly to annoy him—which was, to find an Englishman who could not speak French. It gave him a restraint, of which many have complained; but which, on these occasions, solely arose from a feeling of awkwardness on his part, as not being able to converse with his foreign guest. (Anon [J. W. Parker], 1884 : 91–92).

Virtually every scientist visiting Paris attended these soirées of Cuvier's; Pentland thus had opportunity to meet most of Europe's distinguished scientists and certainly came to know well the savants of Paris, as his letters make abundantly clear. He repeatedly mentions English visitors and several times sent on, with letters of introduction provided at Cuvier's instigation, foreign scientists who had visited Paris before travelling to London (e.g. p. 307).

In quest for zoological and palaeontological specimens, Cuvier was in correspondence with diplomatists, naturalists and collectors in many parts of the world; Pentland's letters frequently note the arrival of shipments. In February 1814, Cuvier had married a widow, Anne-Marie Duvaucel, née Coquet de Trazaille, whose husband, Louis-Philippe Duvaucel, had gone to the guillotine in 1797. He son, Alfred Duvaucel (1792–1824), travelled out to India in December 1817, along with another young Frenchman, Pierre-Médard Diard (1794–1860) to collect specimens for Cuvier. Duvaucel and Diard organized a museum at Chandernagor, but were invited by Sir Stamford Raffles,[33] who was then the British governor of Benkulen in Sumatra, to collect in that island at Raffles' expense. It was agreed that the resultant collections should be divided into two parts, one part to go to Sir Stamford Raffles and the Honorable East India Company, and one part to go to Cuvier in Paris. The two Frenchmen duly travelled to Sumatra and amassed a fine collection, but on 4 February 1819, whilst being readied for shipment, both parts of the collection were seized by the Honorable East India Company at Raffles' instigation[34]—an incident which is discussed by Pentland, who clearly reflects Cuvier's indignation (p. 266), and which may well have been the subject of the lawyer's letter, unfortunately incomplete, quoted on p. 257. However, it is evident that Raffles and the East India Company did not obtain all the items from the collection, since Pentland's letters make it clear that some duplicate specimens from it eventually reached Cuvier in Paris (see p. 266). Whether Duvaucel and Diard were officially allowed to retain these duplicates, or whether they were smuggled out, is not clear.

Much vexed by the incident,[35] Duvaucel returned alone to Calcutta; shortly afterwards, however, he travelled to Sumatra (this time at his own expense) and succeeded in collecting for Cuvier further specimens to duplicate some of those that had been seized. The resultant collection was safely shipped to Paris; its arrival is recorded by Pentland (p. 281).[36] Duvaucel then returned to India and undertook further collecting trips on the behalf of his stepfather—around

Dacca, in the Ganges valley and the foothills of the Himalayas, and along part of the course of the Brahmaputra. After returning to Calcutta to prepare for an expedition to Tibet, he fell ill and died prematurely in Madras in August, 1825. Diard was more fortunate. He travelled in Cochin-China in 1821, being one of the earliest European visitors to Angkor. For a while, he continued to ship specimens to Cuvier; later (1824) he worked in Batavia, Java, as a collector for the Leyden Museum; he became a Chevalier of the Dutch Order of the Lion and of the French Legion of Honour, dying in 1863 after accidentally poisoning himself with arsenic employed in taxidermy.

It is important to stress that, during the period in question, Cuvier was not only prominent in scientific circles but also in French politics. He was appointed Councillor of State by Napoleon in 1813; after the Restoration, he was confirmed in this appointment by Louis XVIII and, in 1819, was made President of the Comité de l'Intérieur. Pentland records, in passing, some of Cuvier's political preoccupations, noting for example that 'discussion of the Budget in the House of Deputies has taken up all his time for the last 3 weeks' (p. 272) and mentions himself escorting Madame Cuvier to the opening of the Chamber of Deputies (p. 283). Cuvier was made a baron in 1819, became interim Grand-Master of the University of Paris, and figured prominently in the coronation ceremonies for Charles X. Although he lost both appointments in the ensuing political reshuffle, he was again made a baron by King Louis-Philippe in 1831 and again become Grand-Master of the University. When his other activities are considered, Cuvier's scientific productivity, throughout the years of his association with Pentland, is truly remarkable.

Editorial notes

The letters which follow are arranged chronologically, so far as possible. In some instances, Pentland dated them legibly himself; others show a clear postmark; yet others have pencil dates added by some previous owner (in these instances, internal evidence supports the pencil date). A small residue of the letters bear only an illegible date or no date at all; usually they can be placed into order on the basis of internal evidence, but in one instance (the lawyer's letter) two dates are possible (even though the earlier seems more likely, for reasons stated). In view of the occasional uncertainties concerning their dates, the letters are numbered to facilitate ready reference.

The letters were originally transcribed without amendment, but their punctuation (or, rather, their lack of it) posed problems in comprehensibility, sentences often showing no subdivision into clauses and being separated from one another by colons, commas, or not at all. To add to the problems, new sentences were only rarely begun by initial capitals. The punctuation here given is thus largely imposed by the editors; Pentland's colons have usually been left, but his commas have in general been replaced by fullstops and virtually all commas herein have been inserted by the editors. Pentland strewed capitals rather arbitrarily; his capitalisation is reproduced herein without comment!

The archaic 'ye' has been replaced by 'the' wherever it occurred and the long 's' has been eliminated. Words or letters missing as a result of error, but clearly implicit in the construction of the sentence, are inserted in square brackets. The word 'Ichthyosaurus' is consistently spelled as 'Ichtyosaurus' by Pentland and the word 'courier' as 'courrier'; these mis-spellings have been allowed to stand without comment, since they occur with such frequency. All other erroneous or unusual spellings, and all other faulty sentences whose intended meaning is not clear from the context, are reproduced without alteration but indicated by '[*sic*]'. Some words were in varying degree illegible; where an intelligent guess could be made but complete certainty was impossible, they are followed by '[?]'. All deleted sentences and words are reproduced, inside square brackets, unless illegible; some proved of great interest!

In the attempt to identify persons mentioned in the letters, over 100 volumes were consulted at different times. For reasons of space, these are not listed here save in instances where a direct quotation was necessary for other reasons.

The letters

I The first letter here quoted (in the collection of the Library of the Institut de France, Paris, carton 3252, piece 98) is the most puzzling in terms of date: it is incomplete and we have not succeeded in identifying its author. However, since the subject might well be Sir Stamford Raffles' seizure of Duvaucel's collection (see p. 255), the earlier of the two possible dates is considered more probable:

2 Old Square Lincolns Inn
1st February 1820 (or 1830?)

My dear Pentland—I have been unfortunately prevented from answering your letter before—for which I beg to apologise to you and M. Cuvier. The law upon the subject you asked of [deletion] is as I believe as follows—

Whenever a contract is made between a board such as the Navy Board & any other public officers—if the contract is made between the contractor and the ['boad' deleted] board without any express provision—the Board or Officers of Government are liable to the Contractor as private individuals and any dispute or contest between them and the Contractor is settled in the Courts of Law, in the same was [*sic*: 'way' presumably intended] as a dispute between any two individuals. The action is brought before the ordinary Courts of Law in the usual manner—By the Board or other officers against the contractor to compel him to perform his contract or to obtain the damages occasioned by his not performing it—Or by the contractor against the board or officers who made the contract with him to compel them to pay him what is due to him—As the case may be—.

In order however to [deletion] avoid personal liability attaching to the Officers of the Government who enter into contracts—it is now however most usual to introduce into all contracts made by them an express stipulation—'that they the Officers or board are not to be personally liable although they have entered into the Contract' [lengthy deletion]. When this is the case the Contractors have no remedy against the Board who enter into the contract with them.—The only remedy they have is by a suit against the Crown directly by a proceeding called a *petition of Right* in the Court of Chancery.—This proceeding although differing in point of form from ordinary actions [lengthy deletion] is decided upon the same principles as ['are' deleted] any ordinary action between subject and subject—the only difference is in the form of the proceedings The Crown however proceeds in the ordinary courts of justice . . . *against* the contractors in the same way an individual would proceed against them—except that the action is brought in the name of the Attorney General—but in all ['other' Deleted] respects the Cerown proceds against Contractors and other persons dealing with it, in the name of the Attorney General in the Ordinary [*sic*] Courts of Justice and before a Jury as any one subject would sue another for breach of contract.

I should however observe that all these proceedings are usually instituted in the Court of Exchequer—but that makes no difference as the Court of Exchequer proceeds ['in' deleted] with a jury as the other Courts do—and is not a Court confined to these proceedings only but also decides the same disputes between Subject and Subject and is [deletion] a court open to all the public and for all cases in the same manner as the other Courts.

[Letter incomplete]

All subsequent letters are written by Pentland himself. All but three of them are preserved in the Manuscript Collection of the University of Nottingham; the three additional letters are placed in sequence, but they are distinguished, and their lodgment indicated, in footnotes.

II Franked '20 Ju 1820', Bath

My dear Sir,

I have just received your two letters with that of Mr Conybeare [p. 248] enclosed, which I shall sent back to you as soon as Mr Cuvier has read it.

I am very glad that Mr Conybeare and Delabeche[37] are using all their efforts to make known the fossil remains of the Lias, but I fear they are not sufficiently au fait of the Osteology of the Saurian Tribe ['which' deleted] and especially that of the head, which is the most difficult point of Comparative Anatomy, to establish that concordance between the lost and living species which Mr Conybeare seems to suppose in his letter. You know that we have a good many specimens[38] here at [*sic*], many of which we owe to your kindness, and, from every consideration, I am sure that the fossil species approaches much nearer to the family of Lacertians of Cuv. or to that family which embraces or contains all the Saurians except the single genus Crocodilus. It is not the Saurian family alone which has its underjaw, the other Reptiles are in the same category: ['but' deleted] the manner of articulation with the Cranium is also by means of a detached portion of the Temporal bone, which Mr Cuvier considers as the analogue of the quadratum of Birds: but if we wish to search to what particular class of reptiles the fossil animals have belonged and not remain contented that they are merely Saurians, the examination of the Sternum and of the Sterno-Humeral System clearly prooves [*sic*] that they approach very near to the Monitor, Iguana and Lacerta genera. The form of the extremities and composition of the principal locomotive organs will finally prove that the Ichtyosaurus forms a distinct family in the Saurian orders,[39] much nearer allied to our common Lizard, Monitor etc. than the to the Crocodile, but distinct by being entirely adapted to an aquatic abode.

As to pretended resemblance between the nasal opening of the Proteosaurus with those of the Porpess [*sic*], I think that there must be some mistake. The Porpess (Delphinus phocoena),[40] Like all the other Cetacea, have [*sic*] but one large nasal opening divided by a bony septum, and through which the Animal blows the water which he is obliged to take into his mouth with his food; it is the only way of his getting rid of it. The opening is situated near the summit of the head, and surrounded by the Nasal, Maxillary and Intermaxillary bones, so that there can be no doubt as to its identity with the anterior opening of the Nostrils of the other Mammalia; now it is very well established that no other opening exists, and that the narrow slit of which you speak is observed in a dried head of a Porpess or of any other Dolphin, can be nothing else that [*sic*] what separates the intermaxillary bones, and which in the recent state is filled by soft parts and has no outward opening. Besides it is very well proved today that the Cetacea have no power of Smelling, as the first pair of nerves which are distributed to the nostrils do not exist or are so small as to have hitherto escaped the eye of the Anatomist, and that in those animals the sense of smell is sacrificed for a more important one, that of acquiring its nourishment [*sic*].

I must also reclaim the priority of the discovery of the composition of the lower jaw and its division into 6 separate bones for Mr Cuvier or rather for Mr Laurillard;[41] indeed, from the moment of the arrival of Col Birche's[42] specimens in July last, no one here doubted of it and I think I spoke to you of it during yr. last stay in Paris. I think they wd. do well at least to say so in a note, as if not Mr Cuvier will one day be obliged to reclaim against their discovery. I even, during my last visit to London, pointed out the same, or at least told both Leach[43] and Clift[44] that such must be the case, from the form & composition of the Head: The dentition of the Ichtyosaurus is the same as that of the Monitor, Iguana etc. and consequently I am convinced in separate alveoli [*sic*]. However there may exist of both kinds; as we have not yet made researches sufficiently exact to pronounce with certainty, and as such researches are both very difficult and require a thorough knowledge of the dentition of the whole Saurian tribe, on which Cuvier has made a travail considerable for his great Comparative Anatomy and which will be published in the 5 Vol. of his Ossemens fossiles. I need not tell you that the laws on analogy are strongly in favour of the supposition that the dentition of the Ichtyosaurus is the same as in the Monitors etc.

Although the researches of Cuvier on the Ichtyosaurus have been inconsiderable, we can easily, and I think with strong probability of certainty, pronounce on the position of the exterior nasal opening. These orifices are placed immediately before and a little on the inside of the orbit; we have here three specimens with those orifices very well marked. Now such openings can only be one of three things, either the Lacrymal canal, 2nd the infra orbitary foramen through which passes the infra orbitary nerve, 3rd or [*sic*] the opening of the nostrils. That the two openings situated before the Eyes of the Ichtyosaurus cannot be the openings of the Lacrymal canals, it is sufficient to say that in no reptile of the family of the Sauria is this canal placed outside the orbit, nor indeed is it in any reptile, and at the present moment I do not recollect to have met with any animal in which the Lacrymal canal opened on the outide of the orbit with the exception of the genus Lemur of Lin. in which this conformation is extremely remarquable [*sic*]: no reptile, as I said before, presents it ['and' deleted] although the Crocodile as [deletion] well as many other Sauria have the greater part of the Lacrymal bone, in which the canal is pierced, placed outside the orbital cavity. 2nd ['that' deleted] no reptile possesses an infra orbitary canal, with the exception of the genus Cameleon,[45] as far as I have been able to see. The Crocodiles, Monitors, Iguanas and Lizards, as well as the Tortoises and Serpents do not offer a trace of it, whereas all the Mammalia possess it more or less developped [*sic*], as well as the nerve which it contains, in proportion with the Sensibility of the face. Now it is pretty clear that animals such as Tortoises, Crocodiles and lizards could have no occasion for such a nerve, as their face is covered by a horny osseous envellope [*sic*] which is entirely insensible, in the same way as the nails in the fingers & toes of more sensible animals and like the hoof or cows and horses. We find even a proof of this among reptiles, for the Cameleons which have the face covered by a soft skin also possess infra orbitary nerves: consequently it is not probable that the Ichtyosaurus, which resembles in other respects so much to the Monitors, Crocodiles and other Aquatic Sauria, should ['possess' deleted] present an organisation of the facial covering & of the nervous system of the form so different from these latter. 3*rd* that the two openings before the eyes of the Ichtyosaurus must be the nostrils, every circumstance concurs in favouring. Placed partly in the intermaxillary & limited posteriorly by the Superior part of the nasal bones (which differs from that of the monitors & Iguanas a little I must confess, because in these latter it is the inferior part of those bones which limit posteriorly the nasal openings). Indeed, to constitute the exterior opening of the nostrils it is by no means necessary that the nasal bones should enter into their composition, as the Gavial (Crocodilus Gangeticus),[46] has those apertures entirely formed in the intermaxillary bones, whereas the other Crocodiles have them formed laterally by the intermaxillary and superiorly by the nasal: it is a difference of comparity [*sic*] of very little consequence: finally all researches that we have hitherto made to discover the nasal openings at the extremity of the upper jaw have been unsuccessful, although we have two specimens in which those parts are perfectly preserved: and if such openings existed we must have, I think, discovered them, as we at the first did not doubt of their existence from analogy, and, although Sir Everard Home[47] has given a section of the head[48] where he thinks the nasal canals should be, I am sure nothing conclusive can be admitted from his plate and much less from his description! It is not probable that the Ichtyosaurus had the Sense of Smelling much developped, because it was essentially an aquatic Being: and that this sense was much inferior to that of the living Sauria. The Crocodile is the species in which this organ occupies the greatest extent; in the other reptiles it is much less developped and the olfactory nerve much smaller, the difference arising from the manner of procuring their food ['and of obtaining it' deleted]; but in the genera especially Aquatic, that is those which never quit the Aqueous element, the sense of smelling is entirely destroyed as in the Cetacea, or very little developped and serving rather towards respiration as in the Turtles (Chelones Brongn.); such as, I presume, the use of the nasal openings of the Ichtyosaurus.

The intermaxillary bones of the Ichtyosaurus form the greater part of the Alveolar process, that is contain the greater part of the teeth, at least two thirds of the ['outer' deleted] whole, and forms with the Molar bone the inferior part of the orbit.

I beg you to substitute intermaxillary in speaking of the nasal openings; those openings are placed almost entirely in the intermaxillary bones in the Ichtyosaurus, as I said, but limited superiorly by the nasal, so that now I have not the least doubt as to their identity in the Ichtyosaurus, as I have, I think, shown that the openings before the eyes cannot be the Lacrymal canals and their position in the intermaxillary bones prooves beyond doubt that they cannot be the infra-orbitary holes which are *always pierced in the Maxillary*.

Sir E. Home says in his last ridiculous paper on the Ichtyosaurus[39] that he has found the bones of the pelvis: I should like to see them, will he publish them?

As to Mr Conybeare's new Animal,[49] I will not pretend to judge, but the disposition of the Bones of the arm seem to put beyond a doubt that it is very different from the Ichtyosaurus. I cannot say any thing on the bones of the hand, as some of them are placed in a supposed position, because I fear that naturally these oval bones, which resemble to those of the carpus of an animal, were not along side the longitudinal ones, which resemble more to the Phalanges of certain Cetacea and Tortoises & to the same animal as the round bones which formed its carpus. But relative to the Sternal Bones, or what Mr C.[50] calls his Clavicle and Scapula, I cannot adopt his opinion: in finding a resemblance with those of the Crocodile, my reasons are the following, but before giving you them I must say a word or two, as those bones in the different class of Sauria. All vertebrate animals have the anterior extremity connected with the trun by means of a broad bone for the insertion of the suspensory or connecting muscles. This is the *Scapula*; its identity is easily discovered in the 3 first classes of the Vertebrates. In some animals this bone is connected with the trunk and its connexion strengthened therby as [in] man, the Quadrumana and in fact all the animals which enjoy considerable facility of motion in the anterior extremity: whilst all those which do not possess clavicles, such as the Pachydermata, Ruminants and many Carnivores, enjoy a much less facility of motion. On quitting the Class of Mammalia and entering that of Birds, where the facility of mouvement [*sic*] must necessarily be increased, nature has given to those animals a double clavicular apparatus; this first consists in a forked bone which Mr C.[51] calls the Clavicular furculair and whose use is to separate the two extremities to prevent their too near approach during flight; and is the real and analogous bone of the Clavicle of the Mammalia and consequently of Man. There is no doubt then that this furcular bone is the clavicle, since it gives (attaches) origin & insertion to the same muscles as that bone in Man. The second bone is what has hitherto been improperly called clavicle and which connects the true Scapula to the Sternum. It is in many species a distinct bone at all ages, and in every species seperated [*sic*] during the early period of life from the Scapula. It is in the interval that seperated [*sic*] the Scapula and clavicle that the Humerus is articulated or in other words that is placed the glenoidal cavity. It is not long since the true analogy of this bone was pointed out, and only by the comparative anatomy of the muscles which are inserted into & which arise from it: the muscles which arise from [it] correspond perfectly to those which arise from the Coracoid process in Man and the other Mammalia, and consequently this pretended Clavicle is nothing else than the Coracoid apophysis which is much more developped than in Mammalia, because ['the' deleted] its muscles are much more powerful. From Birds to the Saurians there is but one step, for on examining the Crocodile we find two bones of nearly equal size supporting the anterior extremities. The first and superior of those bones is the Scapula no doubt upon that head, but the second or pretended Clavicle is nothing else than the Coracoid apophysis of Birds more developped and hence obliged to [deletion] stand in place & fulfill the function of the furcular, clavicle and Coracoid apophysis. The muscles which arise from it and all its relative conections [*sic*] tend to confirm this fact, so that Mr Cuvier (Regn. Animal. 11. p. 19) observes correctly 'que les Crocodiles sont les seuls Sauriens qui manquent des os claviculairs, mais que leures apophyses coracoids s'attachent au Sternum comme dans tous les autres Sauriens'. I have had occasion lately to confirm this opinion in the dissection of a small Crocodile which we have had here: The Clavicle of the Monitor Lizard Ichtyosaurus etc. is nothing more than that of the crocodile with the addition of the furcular bone of Birds and with the first bone of the Sternum considerably augmented in size, so that before the true Sternum are found the furcular, two large flat bones which correspond to the anterior bone of the Sternum of Mammalia (which is always larger than the following) and the two Coracoid apophyses, improperly called Clavicles. The same disposition more or less is to be found in the Ornithorhynchus and Echidna.

After this long and, for you, tedious and uninteresting (I fear) preamble, let us come to your fossil. From the sketch, I clearly see that the bone can only be the Coracoid apophysis; its form, its connexion with the Scapula, its forming with this bone the glenoidal cavity to receive the head of the Humerus, all concur in establishing the correctness of my opinion, so that if you have any influence with Mr Conybeare you would do well to suggest to him to correct the fault he is about to commit in calling it the Clavicle.

Those two bones alone are sufficient to prove that the Plesiosaurus belongs to the same division of Sauria as the Monitor, Ichtyosaurus &c. but to that subdivision or at least near to that family which contains the Ichtyosaurus ['which' deleted] or especially aquatic [*sic*]. The structure of the foot sketched by Mr Conybeare would seem to point out a species of passage from the Living

Lacerta with clavicles or furcular bones to the Ichtyosaurus and establish a kind of link between the Sauria actually existing and the inhabitants of former worlds. The name of Plesiosaurus is a very good name I think, perhaps a little too relative; would it not be better to give some other name which would express either some peculiar structure in the animal, or one relative to its high antiquity, while retaining the termination *Saurus* which I think has been very happily chosen, as that of *Therium* for the Quadrupeds (Mammalia).

I should be glad in yr. next letter, which I hope will be soon, to let me know if the oblong quadrangular bone, in the centre of which I have made a [illegible: possibly 'strand'], are surrounded on all sides by an articulating surface as in the Ichtyosaurus, or if that articulating surface was only at the superior or inferior extremity as in the metacarpal bones and phalanges of the Dolphin & Tortoise.

I can say nothing on the vertebrae.

On the whole I think Mr Conybeare will render to the fossil Zoology & comparative Anatomy a great service by publishing his present observations & continuing his [deletion] researches on those animals, and am sure that, although having fewer opportunities than Sir E. Home, he will, from that Philosophical spirit of research and investigation which he has shown in his Geological memoirs, render a much more essential service than that ['of' deleted] which have rendered the different abstruse, incomprehensible and for the most part uninteresting (except by the Plates) papers of the London Baronet,[52] which, crowding the Transactions of the oldest Scientific Society of Europe,[53] have often prevented the publication of others much more interesting for the scientific world. and much more honorable to the Society from which they ['emanated' deleted] were worthy to have emanated [*sic*]. I shall be very happy to see Mr Conybeare's paper as soon as published and am extremely obliged to you for your kind offer to send it to me as soon as it appears.

Mr Conybeare's letter gives me a still higher opinion of its author than that which I had from what you told me of him. I wish he would come over to Paris ['before' deleted] after the publication of his paper, ['it' deleted] and to prepare himself for the subsequent ones which he intends to give on fossils; it would be of great service to him.

My Dear Sir, Excuse this long dissertation or rather list of Objections, but believe that they are frank and only calculated to prevent mistakes. Receive them as frankly as they are given and you will oblige

Ever Yrs. sincerely
J. B. Pentland

To Revd Wm Buckland
C.C.C. Oxford

III

Au Jardin du Roi,
20 Sbr. 1821

My Dear Mr Buckland

I have just received both yr. letters, the one on Saturday last and the other this morning. I am happy to find by the latter that yr. boxes are safely arrived in London; fortunately I had not made as yet any enquiries on the subject when yr. 2nd letter arrived.

Mr Cuvier desires me for the moment to thank you for the superb present you intend to make him, he will write to you very soon himself more fully on the subject. I am sure nothing can be more liberal on your part as [*sic*] such an offer, which ['will' deleted] at the same time that it will render Mr Cuvier under an obligation to you personally, will ['be' deleted] advance in his hands considerably the history of this interesting and extinct species: he is now working precisely at his article Rhinoceros for the new edition: he has suspended it in awaiting the arrival of yr. head.[54] You do not say if the lower jaw is with it. The absence of the teeth is of little consequence as there exists very little difference (and no Specific one) with the living Rhinoceros. You know that some Zoologo-Geologists advanced an opinion that the fossil Rhinoceros was the same as that from the Cape of Gd Hope. We have just received a fine skeleton of this latter, there is a very considerable difference. Neither does the African Rhinoceros resemble that found in Italy. It appears therefore that there exists two species of fossil Rhinoceros, one with an elongated occipital ridge, a bony nasal septum and bicorn. [Deletion] It is most common, found in Siberia, England & Germany. The other more nearly allied to the Indian species by the general shape of the head and only found in Northern Italy.

Mr Cuvier is also much obliged to you for the trouble you have taken in getting the drawings of his Elephant's jaw at the Geological Society. Could you persuade Clift or Sir E. Home to let us have a rude sketch of the Malayan Tapir, but more especially of its bony head, & of one or two of its grinders. We expect soon one here, but *en attendant* our curiosity is great. In such an occasion, it would be curious, in my opinion almost impossible, that the Tapir of the Promontory of Malacca was the same as that of South America, the *habitat* of the larger species is in general ['very' deleted] circumscribed within very narrow limits.

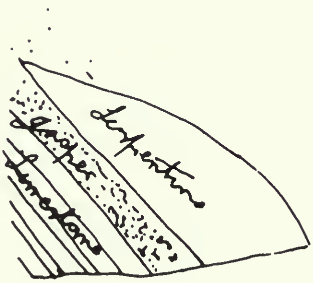
Cuvier has nearly terminated his article on the fossil Crocodile and will immediately set too [*sic*] that of the Ichtyosaurus: his drawings are all finished and ere long we shall have a good description of this anomalous REPTILE. Your specimens will also arrive very à propos. I shall answer for their safe return. Will you send your Stonesfield reptile[55] or will you publish it yourself?

As you send so much, Mr Cuvier expects to make you some present in return: Let me know what you wd. like to have most of what can be Gained here.

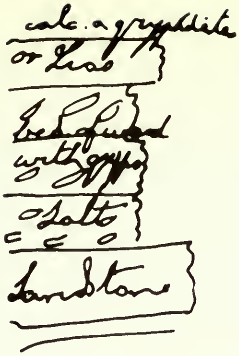
We have just received one of the most numerous collections of Zoology & comparative anatomy that has ever arrived in Europe: it comes from the Cape of Good Hope. Among other most interesting objects there is a complete and perfect Skeleton of an immense Hippopotamus, a skeleton of Rhinoceros bicornis, and several others. The former is come very à propos for Cuvier's paper on the fossil Hippopotamus; for the present I can assure you that, after a hasty description which I myself have made and comparing it with the fossils of the Museum, I find that there exist differences very considerable (perhaps Specific), so that the fossil bones appear to belong, like those of the elephant & Rhinoceros, to extinct species.

Brongniart[56] proposes to write to Mr Stokes[57] on the subject of his trilobites. He, in conjunction with Desmarest,[58] is preparing a considerable work ex professo [*sic*] on fossil Crustacea or Crabs, in which he will describe all and figure the greater number of those actually known. Perhaps this will induce Mr Stokes to let Brongniart have his drawings for an object of such general utility. If you should see Mr Stokes before, pray speak to him on the subject.

Brongniart is also About to publish a paper on ['the' deleted] a superposition of a rock which he calls Serpentine but which appears intermediate in its nature between Variolite & Gabbro of Von Buch[59] or Euphotide. It lies on ['a' deleted] much reddened beds of jasper of flinty slate, which repose themselves on beds of limestone which is analogous to that of the Piedmontese Alps of that of Genoa: this locality is not far from the town of Spezzia, State of Genoa.



What is your opinion on the Secondary gypsum? Do you believe that there exists more than one ['between' deleted] formation or deposition immediately under the Calcaire à Gryphites or Lias, the same as that of England, which contains Salt, and which is in a like position at Salins in the Jura, ['always' deleted]. This gypsum always calc. à gryphites or Lias is accompanied by



Salt Springs, The marginal Section is found at Salins. The Sandstone is probably a member of the same formation as that containing salt.

I am glad Leach gets on so well. Write to me by next courrier or, as soon as you can, let me know when you think you can send the Rhinoceros head, as Mr Cuvier desires me to ask you.

Mr Cuvier and family desire to be kindly remembered to you, as also does Dr Robertson,[60] Underwood,[61] Brongniart and our good little friend Laurillard. Remember me kindly to Daubeny[62] whose 2 or 3 parcels on Auvergne are enough to frighten any moderate Doubter and a sufficient warning against subscribing to Jameson's Journal.[63]

Believe me ever yrs. most sincerely
J. B. Pentland

I enclose a letter for Mr Stokes. Pray send it to his address in London.

To the Revd Professor Buckland
Corpus Christi College
Oxford, England

IV

Paris 6 Novr, 1820
au Jardin du Roi

My dear Mr Buckland,

After all Schlotheim's[64] discovery of Human fossil Bones is nothing but *an Humbug*. He has just formally contradicted the assertion of his book[65] in Ocken's Journal the *Isis*,[66] he throws the entire blame on his bookseller who appears to have introduced it into his book to enhance ['and' deleted] its value, and consequently encrease [*sic*] the sale of the ['Book' deleted] work. It is a good way to throw of [*sic*] one's own shoulders the charge of ignoramus and Charlatanism which Schlotheim has shown in the *rigorous determinations osteological* of the different Cock's and Hen's bones which he supposed to belong to father Noah. I told you, the moment I heard of the circumstances, that I considered it improbable & am happy now to be able to confirm my prophesy. I have just perused Schlotheim's book, it appears to me to be a most incongruous and certainly useless composition. He gives upwards of 100 pages of fossil Mollusca, employs many new names without citing a single figure. I need to say nothing more to you on the merit of the work.

I have considered your observations on the Diluvian gravel which you were so good as to discuss with me. I am now almost entirely converted, and expect anxiously the publication of your paper on the Gravel Beds. The account which we have just received of the immense blocks which have been lately thrown up during the tempestuous weather on the coasts of France & England are strong proofs of the comparative effect of fresh water rivers and of the sea in the removal and deposition of those large Blocks, which which [*sic*] are so abundant in the diluvian gravel beds all over Europe: but in adopting your ideas on the diluvian gravel I am very far from supposing with you that the remains of Animals contained therein belong to individuals which formerly lived in the latitudes where they are actually found. The climate of our northern latitudes must have materially changed to have allowed Rhinoceros & Hippopotamus, now limited to the torrid zone, to exist where their bones are actually found. Such a change of climate is inconsistent with the established laws of Meterology & astronomy, and I cannot see, were it possible to introduce such an hypothesis, any service that it could be towards the explanation and full confirmation of the last diluvian '*Cataclysm*': On the contrary, if you suppose that the bones of those animals have been deposited where we find them or nearly so, by their former possessors, it will be a strong argument in favour of those who suppose that the last deluge, (that consequently which is recorded in the Mosaic History), was rather partial or restrained to certain countries, than general over the entire earth's surface. For a long time I was a warm advocate of this latter opinion, but I now begin to stagger, according as I advance in the study of the Zoology of the antient [*sic*] world, where I find the distribution of its genera & species universal as far as Geological investigations have yet been able to proove [*sic*]. It is now an established fact, that in all those countries where the study of fossils has been cultivated, from the Cordillera of Quito, Imbabura[67] & the Plains of Peru to the most northern parts of America, passing then into the old continent, we will find in every part of it ['that' deleted] the remains of an Elephant very different from those actually existing and which does not offer the least difference from those which we possess (here) from Peru and Quito, I say who can suppose that this species was so universally distributed over the earth's surface as to have ['existed' deleted] lived every where, where his remains are found. Is it probable that the Elephant of the Lena[68] could have inhabited Peru, or that of our temperate latitudes, the equatorial regions? Modern Zoölogy offers us no such a general distribution in any of its species, and it is highly improbable that the laws of Organic life were other in former times than they actually are. In my humble opinion it is much easier to suppose a general dispersion of the remains of [deletion] certain genera & species all over the globe's surface by the effects of the last and very recent diluvian action, than to call into our aid a deterioration in which certain climates [words missing] or an universal equality in the distribution of heat over [deletion] the globe in order to allow the same beings to exist from the Pole to the Equator. Either of those latter suppositions are, I may say, equally absurd, the laws of Necessity and Astronomy cannot admit them, and I am sure no Zoologist who is acquainted with the actual distribution of organic life over the surface of this Planet will attempt to call them to his assistance: I have adduced the Elephant for example, I might have equally taken the Mastodonte à dents étroites,[69] The Lion of Gaylenreuth[70] and the Hyaena[71] certainly never lived in Franconia, although it be the opinion generally adopted that they died where their bones are found. Such an opinion were natural enough from the local accompanying circumstances, had they not been found elsewhere dispersed in the Diluvian gravel. They thus enter, for me at least, into the common category with the ['other' deleted] remains of the other antediluvian animals properly speaking: it is not probable that, within so short a span of time as that which has elapsed since the last revolution of the globe, that [*sic*] nature has so far changed in her operations as to circumscribe within very narrow limits those animals whose remains are every where almost, might I say, found. Instead of endowing them with a constitution & a Structure which would allow them to inhabit, without detriment to themselves, every part of the globe's surface, as you are inclined to suppose, faculty which man and man alone now [deletion] a day [*sic*] enjoys amongst all living beings.

Brongniart is about to publish his paper on the Trilobites which he read five years ago at the Institute and which has hitherto remained unedited: He requested me to beg your assistance by sending him if possible ['an' deleted] some Wax or plaster of Paris moulds of the most remarquable [*sic*] of your own collection or of those to which you may have easy access. I write by the present Courrier to Mr Stokes on the same subject who you know possesses so fine a collection; would you second my demands, as I fear that they may appear highly unreasonable on my part from our slight acquaintance.

I had a long conversation yesterday with Beudant;[72] he insists on making your formation of green Sand a subordinate part of the Chalk. Such for those who have seen the extent and make up of the green Sand ['will' deleted] appears an absurdity—difference of composition, fossils &c. In my opinion passage from one formation to another, as in the present instance, cannot establish identity. Is granite or gneiss to be considered as the same formation as Mica-schist because passage may be observed from one to the other?[73] That from Chalk to greensand is nearly the same thing: I think that the French do not really know what the green sand is, from what their writings & their conversation show us on the subject.

I shall expect to hear from you. How is Leach? Any new fossils discovered?

Believe me ever yours ever sincerely & devoted
Joseph B. Pentland

V

ADMINISTRATION DU MUSEUM D'HISTOIRE
NATURELLE, AU JARDIN DU ROI

23 Decr. 182[0]

My Dear Sir,

Your description of the Fezzan & Tripoli rocks is extremely interesting. I have seen Brongniart this morg. [morning]: he is highly pleased with it, it is a further extension of the Tertiary strata, hitherto considered within so narrow limits. I expect you will let me know what Lieut Lyon's[74] Plain of Bones is; I hope it, when explained, will turn out as the Petrified men of the same country lately described or rather explained by Capt Smith.[75] Make all possible enquiries on the subject. I have communicated yr. letter this morg. [morning] to Cuvier. He desires me to request from you an explanation on the Subject when you shall have had it from the author. I am almost certain that, if those bones really exist, that [*sic*] they belong to fossil species, as in a country so thickly inhabited by carnivorous animals, especially Lions and Hyaenas, it is not probable that the bones of their victims would be left entire, as those animals eat even those parts as far as our observation extends; it is probably a Second Depot like that of the Vale of Arno. I hope it may turn out as such; at the same time as it shall extend our knowledge on the inhabitants of a former world, will extend farther the distribution of fossil species; circumstance highly favorable to my ideas on the subject, which I detailed to you in a former letter.

The Verses[76] on your death has made every one laugh [*sic*]. Underwood has found them so good that he has requested a copy.

Have you any sections of the red marl on the Magnesium Limestone? Could you give me yr. opinion on the Secondary Gypsum?

I enclose a letter from Brongniart for Mr Stokes & one from myself on the Subject of the Trilobites: will you forward these.

Believe Me Ever
Yrs Very Sincerely
Joseph B. Pentland

au Jardin des Plantes
20 Dec*r*. 1820
12 o'C. [12 o'clock?]
(forwarded to Revd Professor Buckland, Axminister, Devon)

VI

21 January 1821
Jardin du Roi
Paris

My Dear Sir,

I have just received yr. letter of the 10th inst. by the courrier as well as that which you sent ['by' deleted] in Mr Cuvier's parcel; Mr Cuvier desires me to present you his thanks for the Book and Drawings which you were so good as to send him and intends writing to you himself one of those [*sic*] days, as soon as he can find a moment's leisure: in the mean time he desires me to say that he is under the greatest obligation for the Rhinoceros' head,[54] which he expects with impatience as he is just about to finish the article Rhinoceros for his new edition, the first volume of which will appear in May as the enclosed prospectus will inform you. It will contain the Introductory Memoir, the Ibis, the Elephant, Mastodon, Rhinoceros & Hippopotamus.

Mr Cuvier says he will be almost ashamed to accept your new & superb specimen of Ichtyosaurus; however he expects to make you some slight return, and we have already put by, or are about to do so, a collection of Montmartre Specimens. He will of course neither mention in his work and, if you require it, in the Gallery of fossils of the Museum when it shall be deposited that you are the donor. However, that will entirely depend on yourself. From your description I am almost certain that we have here nothing equal to the Specimen you intend sending.

With respect to the Drawings of the fossil teeth from the neighbourhood of Genoa, the one appears to belong to the Hyena and the other to a small and distinct species of Hippopotamus which Mr Cuvier calls the Petit Hippopotamus. However, from the drawing it is extremely difficult to pronounce positively as to this latter from the manner in which they were taken. ['Did you' deleted] In such drawings it is much preferable to have them made of the crown of the tooth, or the grinding portion, than a lateral one as unfortunately you have made. However, by having a slight etching made of the grinding portion you would facilitate much its determination. One thing we can almost positively assert is that it belongs to *Palaeotherium* or *Anoplotherium*, as you will be able to convince yourself more fully when you shall have caracterised [*sic*] specimens and well determined under yr. eyes. I have not yet been able to see Brongniart to ask him about the formation near Genoa, but will as soon as possible, and will write to you soon on the subject.

I have not heard from Clifft [*sic*][44] for some time. I should be glad to hear something of the collection sent by Sir Stamford Raffles and which he legally Stole in my opinion from Mr Duvaucel.[34-36] However they have retained duplicates of the greater part of the objects sent to London, which are to be transmitted to France as soon as the arrival of the collection in London shall have been known in Calcutta. Mr Duvaucel is at present in the Dutch possessions in Sumatra at Palembang: our government or at least the India Company has lost a valuable person, I fear by the Caprice or perhaps the Jealousy of Sir St. Raffles.

You would much oblige me when in London to ask to see the Squeleton [*sic*] of the Malacca Tapir; does it materially differ from the American species by its head & its teeth, and in what are the differences, if the[y] exist, the most remarquable [*sic*]. I shall write to Clift on the subject but fear that he might feel unwilling to answer these questions as [deletion] Sir Everard Home has, I presume, a paper on the Stocks (such as it is) on the subject.

Brongniart I believe does not intend to publish a book *ad hoc* on the Geology of Italy, and only separate and detached memoirs on the Subject in the different Scientific journals & especially the Journal des Mines. He has already read a paper at the Institute on the *gisement des Serpentines* in the Piedmontese territory; he has found them lying upon beds of Limestone which appears analogous with the oldest Derbyshire. This limestone contains beds of a red ribbonned [*sic*] Jasper which forms immediately under the Serpentine a bed of itself of considerable thickness.

Brongniart has not yet heard from Mr Stokes.

I am sorry to hear that poor Leach is not better or at least that you are not pleased with the last news you have had of him. We have had a report that he was replaced at the British Museum by a Mr Stevens.[77] This I cannot believe as I am sure that the Trustees would not be guilty of such an injustice, and as we have never heard of Mr Stevens' reputation as a Zoologist, I beg you to let me hear from you on this head.

Humboldt[78] is about to publish a new volume of the Travels in South America;[79] we hear nothing as yet of his geological labours.

Beudant's[72] book[80] is in a considerable state of forwardness.

Mr Cuvier has already written to Mr Lambert[81] at Calais to receive and Transmit to him by the Diligence your Rhinoceros & Ichtyosaurus's Heads[82] on their arrival. I would recommend you send them by land to Dover, as some weeks might pass in case of yr. sending them to Calais direct by water from London.

Mr Cuvier & family desire to be remembered to you.
Believe Me ever Yrs. Very Sincerely,
J. B. Pentland

[POSTSCRIPT] I have just seen Brongniart. He presumes that the teeth came from a place called

Cardi Bona near Savona, not far from Genoa, as that of the Museum of Genoa was found there; if so he supposes that the formation of Lignite is of the same age as the Subappenine Hills, and thinks that the formation of Savona, Cardi Bona, St Remo &, to the SE of Genoa, Castile Nuovo are in the same formation, as respects the central chain of the Appennines on the South, as Castle Arquato, Piacenza & its environs are on the north of the Chain. He is also of your opinion that the formation is of the same age as that in which Escher[83] found his Castor's head. As soon as his paper on the Serpentines will be published, he will [deletion] read another on the modern formations of Italy. He wishes that you would give your ideas on the same subject, in some of yr. Scientific journals or Transactions.

Could you not lend Mr Cuvier the teeth of which you sent drawings. He will return them with the Mt Martre Bones which he intends sending you. Let us know the day your Rhinoceros & Ichtyosaurus head will leave London, so that some person may receive it at the Diligence. Beudant's Book will be in 3 v. [volumes] in 4to with an Atlas price 70 francs. Brongniart and Brochant[84] send their respects to you. J.B.P.

To the Revd Professor Buckland
C.C. College
Oxford, England
Care of *H. Heuland*[85] *Esq*

VII The next letter is from the collection of Dr & Mrs V. A. Eyles.

Jardin du Roi
21 Feb^{y} 1821

My Dear Mr Buckland,

I received your letter of the 16 Inst announcing the departure of the Rhinoceros's head and the Bones of the Ichtyosaurus, which I immediately communicated to M Cuvier; he requests me '*de vous faire de sa part ses remercimens* [sic] & *de vous demander mille pardons pour n'avoir pas encore repondre à votre lettre obligeant*', but as soon as he shall have a moment's leisure he shall write to you. He is now busily employed in getting ready his annual rapport [*sic*] for the Publick meeting of the Institut (which will take place in March) and which I will send you when published. He is also busy at Sir Joseph Banks's[86] Eloge[87] for which I fear he has not sufficient materials. His first Volume of the Ossemens fossiles is finished, and is already part printed & many of the Plates already engraved. It will contain the Preliminary discourse much augmented. I have already read a considerable portion of it. It seems to me to establish in the strongest manner the fact of a general deluge, the Epoch of which cannot be farther back than 5000 years. He discusses the traditions and historical documents of the different people of antiquity, as also those of the moderns, especially the people of the East as the Hindus the Burmans &c, & arrives at the same conclusion.

The first Volume will contain besides the Preliminary discourse the Chapters on the Rhinoceros, Elephant, Mastodon & Hippopotamus.

You say Sir Everard H. intends publishing a description of the Indian Tapir and Sumatran Rhinoceros. I hope it will be better than his papers on the Ichtyosaurus. However he has [*sic*] better make haste as we expect daily those two objects from India with many others which compose a very large envoi from Sumatra; if they arrive in time the description of the Rhinoceros will be incorporated into the body of the first Volume, if not it will be published in a supplement. To give you some Idea of the additions to his Second edition of the Ossemens fossiles it will suffice to say that it will contain the Osteological descriptions of many living species hitherto undescribed, namely the Sumatra & African Rhinoceros, the Hippopotamus, the Malayan Tapir, many new species of Carnivorous Animals, the Orycteropus, Tamandua & Tamanoir species of the Ant Eater family, besides that of the Dugong and of some new species of Dolphins. Add to those 3 or 4 entirely new fossil Genera of the order of the Pachydermata.

Brongniart is hard at work; he will soon publish his memoir on Monte-Bolca, the outline of which I shall give you in my next. He is inclined, he tells me, not to adopt your opinion that the Nummulites belong exclusively to formations of the same ['epoch' deleted] as those of Paris: as to y^{r}. other opinions he agrees perfectly. He is about to publish his work on the Trilobites which will soon appear; he requests me to beg of you to favour him with a notice, however short, on the Disposition and relative age of the Dudley-limestone. You will thereby render him a great Service, neither Brongniart or myself has heard as yet from Mr Stokes or do I suppose ['will' deleted] shall we.

I am very happy to have so good an account from Leach, I have just received a letter from himself which is [deletion] evidently written by a person in a rather disturbed state of mind.

I intend going in the beginning of April to visit the NW coast of France, where the whole succession of Secondary Strata may be seen, in an extent of about 30 leagues, from the red sandstone to the Upper Chalk; the Sections are good all the way. In your next letter would you let me have a section of the Southern Coast of England from Dover (where Phillips[88] has left it) to the Primitive Strata. Does the red Sandstone ever appear on y^{r} Southern coast?

Adieu My Dr Sir
Believe Me Ever Yrs very Sincerely
J. B. Pentland

[On back of letter, around address]

If you see Mr Stokes, will you speak to him about the Trilobites. I think you would much oblige Cuvier much [*sic*] by offering to give him a short notice on the Lias formation & others which contain the Ichtyosaurus & other reptiles.

Have you yet proposed Cordier at the Geological Society, ? or do you intend to do it?[89]

Write to me as soon as you can about the Dudley Limestone.

The lithography [deletion] machine is worth very little I fear; that of Cuvier does not succeed as well as one could wish.

Revd Professor Buckland
Corpus Christi College
Oxford, England
W. S. McLeay[90]

Postmark 'Fe 26 1821'

VIII [The next letter is undated, but internal evidence shows that it was written between 21 February and 7 May 1821:]

My Dear Mr Buckland,

Messrs Cuvier & Brongniart desire me to request to you to send them Mr Mantell's Work on the South Downs[91] (of which you sent ['Me' deleted] me a Prospectus some time ago) with the least possible delay, as they want it for the second edition of the Geology of the environs of Paris. which should appear in August.—The best way wd. be to direct your London Bookseller to send it addressed to Mr Cuvier by the Mail—or by Mr MacLeay—the price I shall remit you either in Books or money. The former I presume you will prefer. [Deletion]. Mr Conybeare has commissioned me to send him Cuvier's first volume which will pay a part of the [£]3 . . . 3 which Mantell's Work I believe will cost: you will specify any other Books you may want. I shall send them punctually.

I wrote to you enclosing the Second part of my reply to Mr Conybeare last Thursday, which I hope is come to hand ere this.

I have never yet been able to get Humboldt's answer to yr. Alpine paper which he promised me.

We expect ['daily' deleted] a very large collection of objects of Natural History this week, consisting of 14 cases of quadruped, birds, fish &c. from Sumatra, Malacca—Java & the Peninsula of Hindostan, collected by Madame Cuvier's son during his unfortunate excursion with Sir Stamford Raffles.

Hauy's[92] new Treatise on Natural Philosophy is just published in 2 octavo vols. His Mineralogy or Cristallography [*sic*] will soon follow.

Cuvier & family desire their best respect to you.

Believe Me Ever.
Yours sincerely,
J. B. Pentland

Have the Book addressed as follows:

Baron George Cuvier,
Conseiller d'Etat,
Secretaire Perpetuel de l'Institut
au Jardin du Roi, Paris

Revd Professor Buckland F.R.S./Corpus College/Oxford/England

IX

Jardin du Roi

My Dear Sir,

I received yr. letter & casts of the teeth from near Genoa, and have handed them over to Mr. Cuvier. They belong to a new genus probably intermediate between the Anoplotherium and the small Hippopotamus, but of this more hereafter.

Will you let Mr Cuvier have a pencil drawing made of your fossil Rhinoceros bones from Warwickshire,[54] especially the Humerus & Os innominatum which you have so perfect, and as Cuvier has no such bones in his new work. He requests you not to take any trouble in having them finished, but merely pencil drawings on a scale of a quarter of the natural size or larger if you choose. If in yr. other Rhinoceros bones from the same locality perhaps you will have portions of the other large bones, either Scapula or bones of the extremity, which might be worth having drawn also [*sic*]. The only thing I must beg of you is to have them done & sent as soon as possible, as his paper on the Rhinoceros will be sent to the press in a few days, the introductory discourse and 300 pages of the text being already printed off. He will keep back the printing until hearing from you.

I send you the prospectus you desired. I hope you have received my two last letters with Brongniart's sections of Italy; tell me what you think of them. I will send you Brongniart's paper on the Serpentines with the Almanack of the Institute, perhaps this day week. B.[rongniart] has promised me two or three of those papers, would you like to have one for some of yr. friends? I will give one to Mr Conybeare.

We have not here the head of the Bos moschatus, but wd. change that of any other animal. Wd. yr. museum change one for a cast of our Palaeotherium head?

Mr Beaunier[93] is returned to Paris highly charmed with England, and very grateful for the attention paid him, he considers himself much indebted to you.

Adieu & Believe Me (in haste)
Yrs. Very sincerely,
J. B. Pentland

24 April [1821]
Monday 2 o'c.

Revd Wm Buckland
Corpus College, Oxford

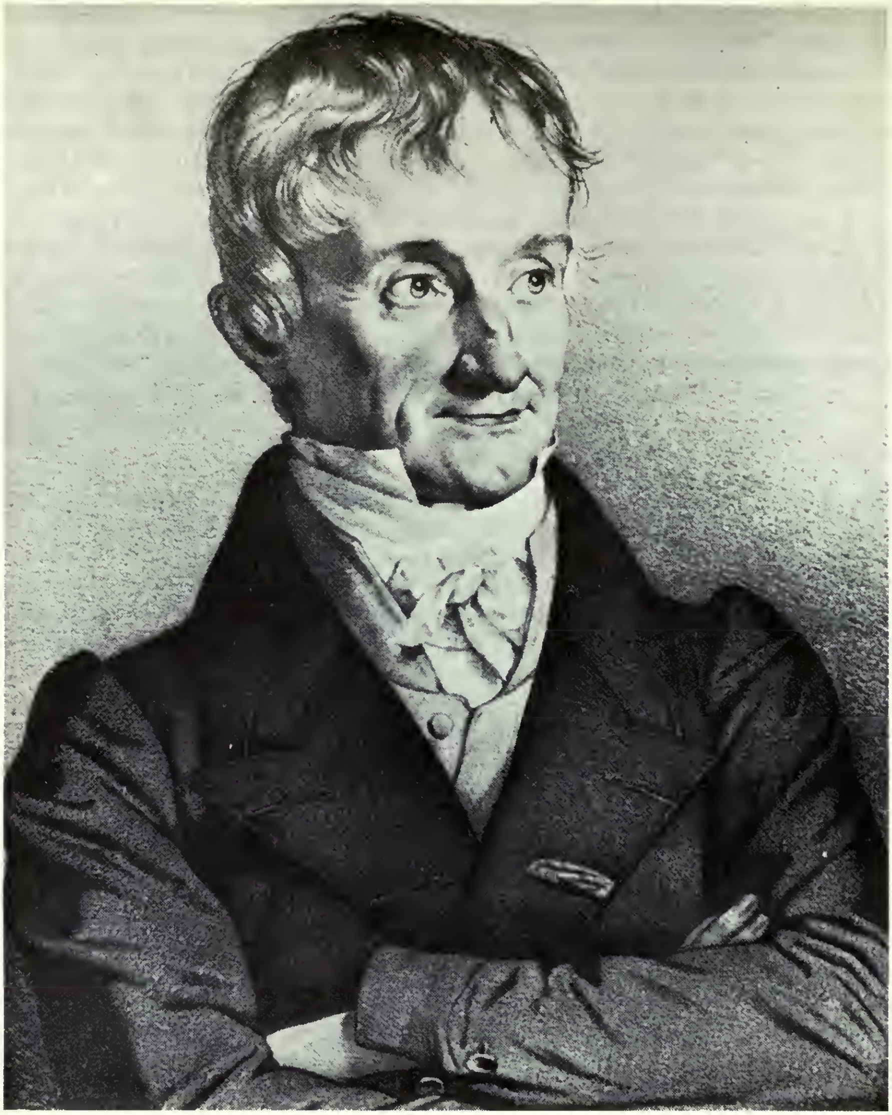
[Postscript on outside] Could you get a small quantity of the Napthaline of Dr Kidd?[94] It is very curious, and unknown here before Mr Beaunier's return.

X

Jardin du Roi, Paris, 7 May 1821

My Dear Mr Buckland,

I have been prevented from writing you by the two last courriers on account of the Easter



Alexandre Brongniart. (Reproduced by courtesy of Expansion Scientifique Française, Paris and M. Paul Ardouin).

holidays and lately by the fetes of the Baptism of the Duke of Bordeaux. I am sorry that I am now able to write you a few lines [*sic*] being very busily occupied in making out the Catalogue of our East Indian collection, which is lately arrived. I am charged with the Classes of Reptiles & fishes. We have received the Malayan Tapir which is very different from the American though indubitably of the same genus, as also an [deletion] entirely unknown and new species of Rhinoceros from Java, very different from that of Sumatra. When I shall have finished by catalogue I shall write a long letter to you.

I enclose a copy of Brongniart's paper on the Serpentines, one for you & one for Mr Conybeare, which you will have the goodness to present with Brongniart's compts. [compliments]. I send you also a copy of the plate of the Coal formation of St. Etienne: which shows the deposition of the Vertical trunks in the sandstone and that of the clay Ironstone which they only now begin to turn to a profitable account in France. I shall send you Brongniart's memoir there upon as soon as published.

Cuvier's first volume will not appear this month. The length of the Discours préliminaire will not allow the paper on Rhinoceros to enter into this volume: so that you will only have the Elephant, Mastodont & Hippopotamus. The second will contain Rhinoceros (very long), Tapir with the osteology of the Malacca species, and Palaeotherium, the third the Anoplotherium & geology of Paris. We are now busy at the Palaeotherium & Anoplotherium; there will be two new species of the former and perhaps two of the latter, from the environs of Paris, besides several others from different parts of France &c.

The cast of Palaeotherium's head is ready. We do not know whether to send it immediately or to wait until 22 other casts which we destined for you to be ready. The head *is extra magnificent*, write to me if you wish it directly, if so I shall send it ! ! !

Believe Ever Yrs. Sincerely
In Haste,
J. B. Pentland

Revd Wm. Buckland F.R.S.
Corpus College,
Oxford, England

XI (Pencil date '28 May 1821'

My Dear Sir,

[First paragraph, lightly crossed out, reads: I wrote to you last Thursday by the French Ambassador's Courrier, in which I answered yr. last letter ['of the' heavily crossed out] but fearing that some delay may occur in the reception of my letter, I think it more sure to write a second time.]

Cuvier desires me to say that he will be highly gratified by the drawings of the bones of Rhinoceros, whatever those bones may be. =either Vertebrae or long [b]ones. For the manner and position in which those drawings should be made, I only refer you to Cuvier's plates of living Rhinoceros, only on a much larger scale if possible, the long bones at least 1/3 or 1/2 of natural size. They will be published in the beginning of his second volume, when Cuvier will have another opportunity of speaking of Miss Morland's talents and of your liberality and zeal: as to the Bos Moschatus Mr C. is much obliged to you for requesting Capt Parry[95] to get him the head. I wd. be glad that you wd. send the drawings of the Rhinoceros bones as soon as you can, as all the plates for that memoir are already engraved. I think I will be able to send you the engraving of the Rhinoceros head which you gave us by next courrier.

Underwood[61] & Robertson[60] are just returned from their Geological trip in Auvergne. Underwood desires me to ask you if, in the middle of July, you will be still in Oxford: he goes to England in a few days.

I enclose you a letter which please to send to London by post, if you have not an immediate opportunity.

Mr Cuvier desires to be kindly remembered to you, as also does [*sic*] Robertson and Underwood.

Believe Ever,
yrs. most sincerely
J. B. Pentland

Jardin du Roi
28 May 1821

N.B. This letter which I say I enclose has been since sent by another person.

Revd. Wm. Buckland F.R.S.
Corpus College/Oxford

Postmark
May 31 1821

XII Jardin du Roi 21st June 1821

My Dear Mr Buckland,

I received yr. letter of the 12th inst. with the memoirs on the geology of the Alps,[96] a part of which I have already distributed. I am much obliged to you for the one destined for me. I am sure both Humboldt & Brongniart will be highly pleased with it, especially with the comparative tabular view placed at the end ['of it' deleted]. As soon as I shall have learned more positivey their opinion on the subject I will write to you. Cuvier has been so busy lately that he has had scarcely a moment's time to read anything: the discussion of the Budget in the House of Deputies has taken up all his time for the last 3 weeks. He has however perused yr. paper on the Diluvian action, and of course thinks highly of it, at the same time as it enters perfectly into his views on Diluvian action. He is only sorry that it arrived too late to be cited in his Discours Préliminaire, the Geological part of which has been printed off more than a month back.

I showed him yr. letter where you speak of the different bones of Rhinoceros which Miss Morland[97] is about to draw: he desires me to present you his best Thanks for the interest you take in forwarding so many new materials for his work, which he says will owe more of its utility to you & Miss Morland's talent than to any other of his friends. I presume I shall receive the drawings by Monday next. Be sure to have the extremities of the Long bones drawn: and a birds eye view of the Condyle of the lower jaw, and above all accurate measurements of the different dimensions.

I am extremely glad to hear that Leach is so far recovered as to be able to return to the Museum. If you should have any news of him between this and yr. next letter be so good as to mention it, as everyone here (Cuvier's family) are extremely interested about him.

I have at last made up my mind to leave Paris for England. I think I shall be in London towards the end of July, in hope of getting out to India shortly after or as soon as possible. You know that my mind has been always tending towards that part of the world, for two reasons. The first, that so very little opening exists today in Europe for a person of my age except endowed with very superior talents & acquirements; the second, that my exertions can be of little use to a country which possesses so many first rate men in every branch of Science as Great Britain. You were so good, during your stay in Paris last Autumn, as to say you would render me any service in your power in forwarding my views, and as you have perhaps as much influence as most Scientific Men in England with the Government I am sure you could render me many services.

My intention was to go out to India as a Medical man, but since I have applied myself so closely to science, and above all since I have seen so much of that little jealousy which is so common in the Profession, I have taken such a disgust to every thing in the shape of Physic that I am sure I never will be able to make my way as a Physician: this is the reason why I do not wish to go out to India in a medical situation, for I have no Idea of taking on myself so important a charge, without being able to fulfill my engagement towards my employer: if I cannot get out to India in some other situation [deletion] in more harmony with my feelings I would much rather remain in Europe. Not in England, as I fear there is there [*sic*] but little chance of succeeding, and I have received more than one proposition from the Russian government to enter into its service, I fear that in case of failing in my attempt to establish myself in India I shall be for ever obliged to expatriate myself from all that is dear to me.

India has long fixed my regards, as a country where there is a great deal to be done in every branch of Natural History. That I am adequate to such a task you will best judge from the opportunities which I have had for the last three years, of having access to all the Museums of Paris, and of following the numerous lectures which are daily delivered on every branch of science in the French Capital.

I began in France by studying Mineralogy and Chemistry, in the first of which I received the greatest assistance from Haüy,[92] who pushed his complaisance so far as to allow ['me' omitted] to visit specimen by specimen his own private collection as well as that of the Garden of Plants, and gave me even private lessons in Cristallography [*sic*], which he said I knew as well as any of his pupils. I have certificates of such. As to Chemistry, Mr Gay Lussac[98] allowed me to follow his lectures at the Ecole Polytechnique as well as the other courses delivered at the celebrated establishment, permission which no other Englishman has before or since enjoyed with the exception of the unfortunate Riche[99] who died in Africa. I at the same time worked for 12 months in the chemical laboratory of Mr Thénard:[100] I then began Geology ['who' deleted] in which I was powerfully assisted by Messrs Brongniart, Brochant,[84] & Cordier,[101] the two first of whom allowed me a free access to their collections, and to that of the Ecole des Mines. It was after receiving from them the Elements of that Science, that by their advice I undertook my voyage into the South of France, in which I visited the Dordogne, Berry, Limousin, Périgord, Auvergne, Cantal, Vivarais, Sily [?], a part of Languedoc, Lyonnais, that part of the Alps in the neighbourhood of Geneva and Burgundy on my return. I thus spent 17 weeks during which time I travelled near 2500 English miles, and all on foot. I may say that it was then that I received for the first time a decided taste for Geology. Since that period (1818) I have been constantly occupied with the same studies, but from the moment that I traversed the Jura that I saw the quantity of fossil remains which it contained, I immediately conceived the utility of the study of ['the' deleted] Zoology, study which very few Geologists had yet taken up. It was then, that becoming acquainted with Cuvier more immediately than I had hitherto been, this great man allowed me to ['study' deleted] avail myself to his labours, by opening to me his collections and by allowing me to work in his own Private Laboratory. He has even pushed his complaisance still farther by permitting me to make use of his own rich Library, to consult his portfolios of notes & drawings, and he has even charged me at several times with the arrangement of his collections, which is confided to another young man & myself. It is not only in encouraging my study and in forwarding my scientific views that I have to thank Cuvier: he has gone still further, I am received into his family as a relation and an initiate, and you know yourself from the manner you have seen me treated by all the family what opinion they have of my conduct & acquirements.

Those are the principal recommendations I have to offer, towards being employed in India, in a Situation such as to be able to render services to Science, in a country where hitherto nothing has been done in Geology and where very few ['little' deleted] of the Animals which inhabit that vast Peninsula are known farther than the coasts. It is easy to conceive why Geology is so far in the background in India, because to be able to geologize, if I may use the expression, a knowledge of that of Europe is necessary and very few persons have more than a mere smattering of that Science. Geology does not consist in the collecting of hand specimens. Its great object is Superposition, object which is now arriving rapidly to something constant and invariable and to which no person has more contributed than yourself. I have been able then to consult & to profit of what has been hitherto done: I have seen also for myself, and have visited with care one of the countries, which offers ['the key' deleted] a kind of key towards the explanation of the causes which produced one of the most important class of Rocks (Volcanic) although not ['and' deleted] one of the most general.

As to Zoology, I will only mention two examples to show how far that Science is cultivated in India, the discovery of the Malayan Tapir which had been a long time in Lord Moira's[102] Park at Calcutta by Mr Cuvier's stepson,[34–36] who was then no zoologist, and since that time the discoverer of an entirely unknown and new species of Rhinoceros. In Icthyology those great rivers the Jumna & Ganges on one side & the Indus on the other present a large field for enquiry, and you know that in Ornithology, from the little already known, the number of objects is immense.

Messrs Diard and Duvaucel[34–36] have discovered in the single Island of Sumatra alone 7 species of Apes, 2 species of Deer, and of Antelope, & inumerable [*sic*] species of Birds and fishes.

To conclude allow me to repeat my request of yr. assistance in my undertaking. Be assured that the advancement of science (which is our favourite pursuit) is the only motive I have in view, & that if [I] shall succeed, I am sure you will have no reason to complain of my labours, & of the interest you shall have taken in forwarding them.

Adieu Believe with most [word incomplete]
regards,
Yrs ever sincerely,
Jos. B. Pentland

To the Rev. Wm. Buckland
Corpus College,
Oxford, England

(Bears seal of 'Fr. Academie Royale des Sciences')

XIII Paris Jardin du Roi 2 July 1821

My Dear Mr Buckland,

I received your letter of the [gap] ult. last Monday, with the drawings of the Rhinoceros bones[103] for Mr Cuvier, with which he is hugely pleased ['and' deleted]. They seem done with much care and a great exact shape: I am desired by Mr C.[104] to present his thanks to you and to Miss Morland for those drawings. There is only one specimen which remains undecided, it is the pl. 6 of a vertebra viewed in 2 positions and which appears to be the Axis of a Rhinoceros. However the odontoid process or articular faces are too imperfectly marked in yr. drawing to warrant a positive determination. Mr Cuvier will get Miss Morland the number of copies she may choose of the drawings: and between ourselves I believe he intends to send her a copy of his work.

I enclose at last a part of my reply to Mr Conybeare. The ideas contained there are in for the most part my own, and have requested Mr C.[105] not to speak of any communication in his papers, at least not to cite my name, for very particular reasons.[106] You will be so good as to request him to do so yourself. I could have written a letter triple the length on the subject, but feared lest aridity of the details into which I must enter would render my description tedious and incomprehensible without drawings. You will see that, from the Osteology of the head, I have arrived so far as to establish the resemblance between the Ichtyosaurus & Lizard tribe, and have thus been obliged to constantly combat Mr C.'s[105] reasoning throughout, which I think I have done fairly, and hope that he will consider the details and reasonings I have been obliged to enter into, as [deletion] arising from no personal opinion of my own but from that love of truth which should actuate every person who wishes to treat of such matters. The principal object of the enclosed letter is to show that the Ichtyosaurus is a Saurian much nearer allied to Monitor & Iguana & Lizards than to the Crocodile, in proof of which the organs of sense and general confirmation, ['and' deleted] speak in favour of. I have only spoken once or twice of Sir E. Home's ideas, which I then shew are ridiculous, as coming from a man placed in the centre of Science and at the head of such a superb Anatomical establishment as the Hunterian Museum:[106] in my next letter (which will be in a week) I shall show that the opinions of Sir E. Home, who at one time wished to make a fish and at another an Ornithorynchus & at another a Proteus of the Ichtyosaurus were as unfounded as ridiculous, that those who wished to make a Dolphin of it did not understand the simplest laws of animal organisation, ['Had' deleted] and that Mr Conybeare in wishing to transform ['it' deleted] into a Crocodile the Ichtyosaurus (which resembles more to the other Saurii) did it from a total ignorance of the Osteology of the monitors, which he had no opportunity of studying. You will besides see by my letter that the first & all essential organs of the animal are constructed on the same model as in animals actually existing, but that the secondary points of organisation are *sui generis*, and authorise the establishment of a new family of Saurii ('in' deleted] which the Ichtyosaurus should form the type of.

I have left my letter open so that you may peruse it if you think it worthy of yr. attention.

I have distributed your Alpine paper, as you desired. Humboldt has promised to give me some notes on the subject which I shall send to you. He still holds out for his old opinion on Bunter Sandstone: he is not of yr. opinion as to Pappenheim, whereas Brongniart is, and as to the Diableretz he still wishes to make it an Alpen-Kalk: I shall send you also an account of what Brongniart will say on the subject. I have not been able to see him for some time: but am to dine at Leons [?] with him in a few days. He will *read today* at the Institut his paper on the *Series tertiaires* of the N. of Italy and especially on the Valley of Ronca & of Mount Bolca. He will publish this paper with plates of the shells of Ronca, which I shall send to you and Mr Conybeare, as soon as it shall appear. Have you seen Greenough[25] since his return? and do you think he has much profited by his Italian trip in getting rid of his scepticism: he made very little impression on the people here during his short stay.

Cuvier's first volume is ready to appear. The printing of the title page is finished, so that in 10 days or a fortnight you may expect to have it in England.

I have read attentively your Lickey Hill paper[108] and am ['almost' deleted] entirely of yr. opinion, as I am sure is Cuvier, but you know that he never gives his opinion on any subject except in Print, and for your sake I am sorry that your paper arrived after that part of his work where he could speak of it was printed off.

I expect daily Mr Conybeare's drawings of Ichtyosaurus, especially those of the Palate & Pelvis, and of the ribs in position. Although we have here all the parts except the Pelvis, the moment is not arrived when they can be laid bare, Mr Laurillard (Cuvier's assistant) & myself being occupied with the Tapir, Rhinoceros & Paris fossils at the moment. The casts of the Paris fossils for your use are now painting. You will be delighted with them. They shall be sent the moment they are finished.

Mr Cuvier & family desire to be kindly remembered to you: how is Leach? I will not go to England before the middle of August.

Believe Ever,
Yrs. very sincerely,
J. B. Pentland

Jardin du Roi chez
le Baron Cuvier

[Postscript written around address] You will explain to Mr Conybeare the haste in which my letter was written, so as to bear some kind of excuse for my style which I only wish to [be] plain and easily understood: [deletion] I will expect to hear from you by return of Courrier, as also from Mr Conybeare.

I would have recopied my letter so as to render it more lisible, but I am now so busy that this was impossible.

J. B. Pentland

To the Revd Professor Buckland F.R.S.
Corpus College
Oxford, England

XIV Pencil date '3 July 1821'

My Dear Mr Buckland,

I am extremely obliged to you for sending the specimens of Ichtyosaurus with Mr Conybeare's paper,[109] both of which have arrived safe. Your polished specimens of the teeth are most interesting and proove [*sic*] beyond a doubt that my opinion was correct in holding out that the dentition was different from that of living Crocodiles, and approaching nearer to that of Lacerta however as I suspected and which I mention in my letter to Mr Conybeare. The dentition is also different ['also' deleted] from that of those latter in so much as the tooth never was intimately united to the bottom of the alveolas by a horny medium, at least so far as I am enabled to judge by all the specimens I have seen, for if you remark the inferior part of the tooth is separated on all sides from the bone in which it is implanted by a layer of calcareous spar, sometimes extremely thin. What Mr C.[110] took for a new tooth within the old one is nothing else than the commencement of the ossification of the pulp, which fills up the bottom of the tooth. The middle part remains hollow as in fishes & Dolphins & in the larger species of the Lacerta family, for a considerable period after the ossification of the pulp below and in some at every period of life, and if you examine with care this new tooth, as Mr C.[110] supposed it you will find it is continuous (in yr. specimen) with the external edge, by a very narrow & uninterrupted line of bony matter which on one side (of yr. specimen is dislocated) [*sic*] but perfectly preserved on the other: besides the new tooth is entirely composed of a porous bony structure, without the least possible trace of a covering of enamel, which [?] should be the case was it in reality a young tooth: the proof of which is that in the same specimen there is the superior extremity of a really new tooth formed and which, although much smaller than that which Mr C.[110] supposes to be such, has its enamel formed, and its entire substance of a much more solid and compact material than in the bony polp of the others. It will suffice to observe those two and you will with a little attention see that they are of quite a different nature, and if the one be admitted to be a young tooth (which no person can doubt) the other certainly cannot. Besides to admit two so very different modes of dentition in an animal, even in the same individual, would be absurd and contrary to every basis of coexistence—& of analogy. Your specimens ['which' deleted] with which you & Mr. C.[110] supposed to confound me, have as you see been the means of confirming my opinion, opinion which I had formed in the beginning, I will now confess to you after the analogy of the head, but which the researches I made previous to writing to Mr Conybeare still confirmed and which finally your specimens place beyond a doubt. There remains then but one difference between the Lacerta & Icthyosaurus, namely that the teeth were never intimately united by a bony medium to the jaw bone, but retained most probably in the long maxillary furrow by the ligamentary matter of the gums, as in Dolphins, supposition which their dislocated nature in the greatest number of specimens renders still more likely.

As to your question if the Ichtyosaurus ever came on shore, I must say he never did as far as we can judge by analogy. Those analogies are founded on his resemblances as to the principal locomotion organs with the Cetacea, which once ashore can not get back to the water, but die on the sand for want of food: the presence of nails on the extremity is not any reason for his not being able to gain the land, because the eared seals (Phoca jubata[111] & ursina[112]) with very small nails, which they certainly cannot employ because of their being placed on the middle of the superior surface of the feet and consequently can never touch the ground as in common seals. However these animals come basking on shore, during the greater part of their lives. As to his breaking his back, this is not possible because of the great elasticity of the intervertebral substance, allowing much greater motion than in land animals. Besides you know than [*sic*: pres. 'that'] fish, when brought out of the water, never are subject to such an accident, although they execute much more violent mouvements [*sic*] when dying than the Ichtyosaurus could when simply driven ashore.

On the whole Mr Conybeare has published an excellent paper, as much superior to those of Sir E. Home as one thing can be to another. His manner of treating his subject has really astonished me, when I consider the opportunity of studying the living species which he had in his power. I wrote a long letter by the present courrier, in which I discuss or rather, critique [*sic*] his paper in the order he has adopted.

Since writing the above, I have received a letter from my friends in London saying that my situation of Medical man in India can no longer be kept vacant for me and that I must go off immediately for London, which I intend doing in the course of the ensuing week. I must remain 2 months in London previous to my embarkation. I therefore beg of you to send me any letters you can for people who may be of service to me in London, especially one for Ld. Bathurst,[113] as that which you gave me is now of an old date. I shall do everything in my power to go to Bengal, where there exists to openest field for research, I shall still hope you will employ your influence to have my appointment changed to that of civil officer. Although the place of Assistant Surgeon in a pecuniary point of view is very nearly the same as that of Writer (which I would like to get), still you can well imagine that this latter situation, at the same time as it is more consonant with my natural feelings, would place me in a much more favourable position to cultivate my scientific views, which is [*sic*] my principal and I may say only object. I could live at home by my professional talents, but then would have no field for any scientific pursuits, whereas in India, although not rich, I will be able to render services to the cause of Science: this is the only motive I have in wishing to go to Bengal. I assure you My Dear Mr Buckland that those chimerical ideas of returning home one day or other with a large fortune are not mine: fortune is certainly due after long services, but that which I wish to gain is instruction and reputation. You have more than once been able to judge whether this is the case or not. The advantages of going out as a Writer would be; that I could get attached to the missions or, if you choose, embassies placed at the courts of the Rajahs or princes in the interior; by this means I would be able to study carefully that country around, and not by post as if I was attached to the army, which I must be if I go out as Surgeon. Such is the account I receive from several persons who have lived in India: and as the place of Assistant Surgeon which I now have is nearly equivalent to that of Writer, I am confident you may be able to procure the change I ask, either by your own friends or your friend's connexions. If I can arrive at this desire, I shall conceive myself the happiest man living: if not I must accept my medical situation, the disgust of which will ['hasten deleted] make me forget and perhaps dislike science in every shape and probably being in bad health which may soon put an end to a life which might be rendered useful. You mentioned Miss Morland's uncle as an India Director, perhaps he could do something: I expect the niece will use her influence on my behalf. However you will know best how to manage, and with the zeal you employ I am confident of success. If there existed a lower civil situation in the Company's service I would not dare to ask for that of Writer, but no such place exists. You may ask if the education I have received is sufficient for to aspire to such a situation: I will only observe that I have ['been' omitted] brought up in the best classical establishment in Ireland (that of Armagh) and that [HOLE IN LETTER: prob. 'since leaving'] School Science has not engrossed my entire time, but that my moments of relaxation have been employed in reading History and other branches of litterature [*sic*]. Relying on your exertions I will say no more, except that I shall be always grateful for yr. past kindnesses, and hope that ['with' deleted] our correspondence (which has been so instructive for me) will not end with my departure from Europe.

I have received Mr Cuvier's first volume, which he desires me to present you as a mark of *Esteem* and *friendship*, & as a small token of his RECONNAISSANCE (which cannot be translated) for the services which your zeal has rendered to Science in general, and to the Study of fossil bones in particular: besides he says that he is glad to acquit a debt for the exertions you have made in rendering his work more complete than it could otherwise have been, by the generous sacrifice you have made of some of the most valuable specimens that the Jardin du Roi has ever received. I cannot send it by the Courrier, being too large, but will bring it ['with' deleted] myself.

I am not yet decided what day I will leave Paris, but it will not be later than the 9th of August so that you will be able to answer my letter by writing by Post. I shall bring with me the cast of *Palaeotherium* &c addressed to the British Museum, your part will be in the same box, as well as a series which Mr Cuvier charges me with for the Governor General of India. By this means I hope to get ['my' deleted] our specimens into England duty free. I hope to be able to visit Oxford before my embarkation for India. If I have time I shall also go to Bath and Bristol and stop a day or two with Mr Conybeare:[114] I would be glad to have letters from you for Sir Everard Home, and any other persons that may be open to me in London such as Mr Colebrooke Barrow of the Admiralty.[115] Mr Lambert. [*sic*][81] If you should have many letters to send, send them by the mail addressed me, and to the care of Mr Heuland,[85] 27 Kings St, St James, or still better to Mr Macleay[90] whose address you know. I shall however expect to hear from you by post before I leave Paris.

Believe me Ever Yours Very Sincerely,
J. B. Pentland

Paris 31 July 1821

To the Revd. Professor Buckland
Corpus College, Oxford

(No postmark)

[Postscript written across first sheet]:

In case of my not succeeding in getting the Writership in India, I would prefer going to New Holland in the situation which you think I could easily get from our Government. In case you cannot do any thing for me in forwarding my pretensions to the Writership, I will then beg of you to do what you can to get me out to New Holland as soon as possible, as a residence in London at the same time as it will necessitate considerable expense, will also be of very little utility to me If you can give me letters for the people at the Foreign office, that may set the business a going, but if [?] you can do more on your return from Scotland [*sic*]. Do you know Mr Croker,[116] will he be of any service to me. I shall deliver the letter you gave me 12 months ago to Mr Ricketts.[117]

XV

My Dear Sir,

I was out of town when your kind letter of the 24 Ult. came to hand ['which' deleted], enclosing yr. deluge paper which according to yr. desire I immediately handed over to Cuvier. I am much indebted to you for being the cause of Mr Conybeare's writing to me, whose letter I cannot answer before 10 days at least, as I shall be obliged to make some researches on the anatomy of the muscles of the Crocodile & other reptiles so as to be fully en état to answer to some of his objections. However I am glad that he adopted my, or rather Cuvier's, opinion as to the position of the nasal openings placed before the eyes of the Ichtyosaurus, and my opinion on the identity of the Coracoid apophysis. Mr C.[118] does not yet seem to me to fully understand the composition of the Sternum of the Monitor, I shall send him sketches of them in my letter which are so much superior to verbal descriptions. I am now busy with a dissection of a bear which will yet keep me 8 days after which I shall set to, in order to answer Mr C's[118] letter. I shall also be obliged to examine, more carefully than I have hitherto done, the mode of dentition of I'saurus as Mr C.[118] holds out for an opinion which, although not very different from my own, is still such as to require to be established on unequivocal proofs. The reasons which I shall bring forward in support of my opinion that the I'saurus is more nearly allied to the Monitor, Iguana Lizard &c. are principally deduced from the structure of the Trunk, and from the head, but I must also admit that in many points there exists a resemblance with the Crocodile; now to be able to establish my opinion I shall examine those parts or organs most essential to life, and in my research I am necessarily obliged to study the soft parts of the Saurian trunk, on which little or nothing has been published hitherto.

I am very much pleased with Mr Conybeare's manner of writing, and am really astonished at the progress he has made in so difficult a subject with so few means. Although young in the business, he will far outshine Sir E. Home, who to his many insignificant memoirs, has just given a most stupid one of the Dugong.[119]

I shall be much obliged to you for the copies of yr. deluge paper which you promise to send me. I told Brongniart & Cordier that I should give them one from you. I am really astonished to say that I have scarcely time to read it. I am at the Garden from 6 A.M. to 8 P.M. every day, busy either dissecting, or picking out Montmartre fossil bones at which Cuvier is now working. He has made out 7 species of Parisian Anoplotherium, c. 8 or 9 of Palaeotherium, besides 2 entirely new genera of Pachydermata, all from the plaster quarried of the environs of Paris, besides a new genus of Carnivorous Animals. To the catalogue may be added three other species of Anoplotherium 2 of which, found in the coal near Genoa, although very different from the species of [deletion] Paris at first view, seem on further examination to offer one of those Anatomical links between fossil & living species, the Anoplotherium & Hippopotamus. The third species comes from Gascony. In Palaeotherium the species out of Paris are more numerous. I should suppose in all the genus Palaeotherium will reckon 15 species, including those of Paris.

I spoke to you in my last letter of a new discovery of the remains of the Gigantic tapir mixed with those of Rhinoceros & Mastodon near Orleans. Another locality has been since discovered in the same country but hitherto has only produced fragments much inferior in point of preservation to those of the first ['locality', and 3½ ensuing lines deleted: 'Mr Greenough has passed through here on his return from Italy. I am sorry to say that seeing and conversing a little with him has not gratified that opinion which the perusal of his interesting book[120] has caused me for form'.] I was to dine with him at Brongniart's, but preferred a friendly invitation to dine at Cuvier's in the family way. G. called on Cuvier, he was invited to come and spend the Evg. there yesterday (Saturday) but did not come, I believe because he was obliged to leave Paris next morning. On this you will have seen him I suppose in England. I offered to be of any use to him when in Paris in my power, and fortunately he did not once accept my offer. He promised to carry a small parcel of fossil shells for you, which I promised to send you some time ago, but he never gave me any notice of the day of his leaving Paris.

I shall write to you a long letter this week by the French Minister's Courrier, I hope you will excuse its object, until then Adieu

Believe Me Ever
Yrs. Most Sincerely,
J. B. Pentland

P.S Have the goodness to put the enclosed letter into the Post Office for Bath. It is from a young lady, a relation of mine.

Are the Drawings of yr. fossil Rhinoceros' bones from Warwickshire nearly ready?

How is poor Leach getting on?

Is it *true that you are coming over to* Suisse???[121]

To
The Rev. Wm Buckland, F.R.S.
Professor of Geology,/Corpus College/Oxford

Postmark date
Ju 22 1821

XVI

Paris
Jardin du Ros
8 July 1821

My Dear Mr Buckland,

I wrote to you this day week enclosing my reply to Mr Conybeare's kind letter, and proposed sending the remainder today, but have not been able to finish soon enough for the Courrier, so that I shall not be able to send it sooner than Friday next by the French Minister's Bag: in order to reply fully to the second part of his letter, I was obliged to pass in review the entire osteology of the Reptiles, and that of the Cetaceous Animals, and Cartilaginous fishes, & to study the most essential points of the soft parts of those Animals.

Mr Cuvier has made out fully and fairly all Miss Morland's drawings. Yr. specimens of the Pelvis & Humerus are extremely interesting. The antick [*sic*] Rhinoceros is ['finally' deleted] finished and sent to the Press. Cuvier's first volume will appear in the course of the present week or very early in the beginning of the following.

Brongniart is very highly pleased with your Alpine paper.[122] You differ from him on some few points, but as to the great essential ones you & he agree perfectly. He has read his his [*sic*] paper on Monte-Bolca & Northern Italy, which I shall send you as soon as I can get proof sheets which he has promised to give me. Young Brongniart[123] has also read a very interesting paper on the fossil plants of the Tertiary Strata, and especially on those of the neighbourhood of Paris. Cuvier intends to publish that part which relates to Paris, in the second volume of his new edition which will contain the Rhinoceros, Tapir, Damas,[124] Horses and Hog genera, and the Geology of the environs of Paris considerably augmented by Brongniart, who has a great deal of new matter to add to this.

I shall send you a paper this day week on the Geology of the neighbourhood of Vienna, by a Mr Prévost,[125] which will interest you, as also a short notice on the affinities of the Trilobites by a pupil of Mr Brongniart.[126]

Young Brongniart has heard that your Stonesfield slate is full of fossil Plants and, as he is preparing now a paper on those inferior to the Chalk, he requests me at the same time as his father to beg of you, if they ['be' deleted] are so common, to send him some specimens which may enable him to speak of this locality in his paper, until he shall have been able to visit the English collections himself, which he intends doing in a couple of years.

I am very glad to hear that your class is so fully attended this year; it is a very favourable prelude towards the prospering state of Geology in Great Britain, and offers a strong instance of what exertion & perseverance on your part can do to render agreeable to the first people of our country by your lectures, a science more pleasing in the field than in the Cabinet. Cordier[101] has not more than 30 pupils this year although his lectures are gratuitous, where every person may step in & sit down. This forms a striking contrast of the wish to learn in the two countries, but I must say that a great deal of this depends on those who deliver the Lectures. Cordier has began [*sic*] a course of 32 lectures, in which he intends to treat merely of the Mineralogical composition of rocks, and of their artificial classification, as every classification founded on Mineralogy alone must be.

Let me know what Mr Conybeare thinks of my letter—and as you will soon be leaving Oxford during the Vacation, where I must address my letters to you.

Mr Hope[127] has told me you intend to come over to France, Is this true? and when will you be here?

We have had Mr Davies Gilbert or Giddle[128] here: he has left Paris full of the idea of establishing in England such an institution as the Jardin du Roi. It appears that he has a good deal of influence with the Ministers on scientific subjects.

The news of Buonaparte's death arrived here last week, and has made no sensation, which shows how much that man's conduct has rendered all people callous hearted towards him.

Mr Webb,[129] an Oxonian who travelled with Greenough, who knows you, desires to be remembered to you.

Adieu & Believe me
Yrs. Ever sincerely
J. B. Pentland

Monday 9 July, 1821
To the Revd Professor Buckland F.R.S.
Corpus College, Oxford

(Postmark illegible)

XVII

Paris 29th October 1821

My Dear Mr Buckland,

I received your kind letter of the [gap] ult. a fortnight ago and immediately delivered the note contained therein to Mr Cuvier. I wd. have answered it sooner had I not been very unwell and am only now getting up after a severe attack of intermittent fever combined with a violent bowel complaint, thank God & Dr Robertson's assistant[130] I am now so far recovered as to be able to go to the Garden of Plants with this letter. I have still some remains of my bowel complaint which I hope will soon go off. I was very sorry to hear of the accident which has happened to you, as was [*sic*] Mr Cuvier's family to whom I related it. Underwood, who has just returned (full of Welsh Geology & with no small opinion of his own geological labors), tells me that when he was in London you were then going about, so that by this time I suppose you are returned to Oxford. Underwood it appears has examined the Island of Angelsea [*sic*] with a Mr Henslow[131] whom he considers a very great man, but in his opinion the Geological Colossus of England is the Cambridge Professor Mr Sedgwick[132] who is his friend, & who has lately written a paper on the Geology of Cornwall[133] which on reading I have found mediocre for a University Professor. I see that Underwood has a strong prejudice against you and Mr Conybeare, at least I fear your friendship with Greenough, whom he considers as a blockhead & whom you I think very justly appreciate,[134] has been the principal cause; however it is rare that two of a trade agree, not that I wish to compare you or Mr Conybeare to Underwood, who is a mere Tyro and a very superficial one. He is ['not' deleted] ridicules [*sic*] the idea of Mr Conybeare's working on fossils. I presume this sentiment is not his own, but that it had emanated from Bedford St or Lincolns Inn fields. He has however spared his sarcasms on Mr C's[135] Ichtyosaur paper, since I have prooved [*sic*] to him its merits & its ['was' deleted] even its imperfections [*sic*].

It appears that Webster[4] & Sowerby[136] are at war in England about the Geography of the Isle of Wight.[137] I depend as much on Webster as on any man for correctness of observation whch constitutes the better half of the Geologist, but as to germs [?] and ingenious inductions I fear he is behind many. As to Sowerby he is a Charlatan, and in the numerous works he has published, there neither exists science, genius, or philosophical views. Besides I should be strongly inclined to consider him one of those men who would wish to make a great book & found a gigantic reputation of the flaws or errors which have escaped his predecessors. As to Webster's paper on the formations above the Chalk, and more especially on those of the Isle of Wight, it has been judged both in England by people capable of so doing, and on the continent by those whose studies, more particularly directed to those more recent but no less interesting formations, have it more in their power than most geologists to judge of such an undertaking. This judgement, which is already registered in the preface to the *Recherches sur les Ossemens fossiles*, will undoubtedly be brought forward with more force in that part of the work which treats more particularly of the Tertiary formations.

You may be astonished at not seeing the 2nd volume of Cuvier's work appear sooner; it is entirely owing to the plates ['of' deleted] relative to the Geology of the neighbourhood of Paris, which are not yet finished. The text is already printed and I shall send you probably by next carrier the proof sheets of the part which is specially dedicated to fossil animals & which comprehends the Rhinoceros, of which there are now 4 if not *5 living species* & at least 4 fossil species. Consequently two more of the former than are spoken of in the 1st edition, & 3 more of the fossil. We have now a fossil species lately discovered not larger than a tapir & another the size of the common Rhinoceros, both of which possess Incisors like the living species of India & Sumatra, whereas the other two are entirely deprived of such, as in that which ['now' deleted] is now peculiar to Africa.—The Article on the Tapir is considerably augmented by the descriptions ['of the' deleted] & figures of the Malayan species which differs from that of America more than the Tiger differs from Jaguar, or Lynx from the Ocelot as far as respects his color and osteology, although both evidently must be placed in the same genus. After the living species Mr C.[138] describes the extinct ones, which are 2 in number & which both exceed considerably even the Rhinoceros in size, if we can judge from the fragments which have been preserved. To those follows the new genus Lophiodon which includes nearly 9 species intermediate between the Tapir & the Palaeotherium, some of which in the first edition were confounded with the latter. To complete the history of fossil as well as living Pachydermata or rather to serve as object of comparison for the Parisian fossils, Mr C.[138] describes & figures the osteology of the Horse & Hog.—The second part of this vol. [deletion] is occupied by the Geology of the environs of Paris, to which Brongniart has considerably ['has' deleted] added, especially to that part which relates to the chalk; he will give upwards of 12 new plates, the greater number representing the fossil shells & invertebrate animals in general contained therein, most beautifully rendered by Lithography, which he has established himself at Sèvres.—The impression of the 3rd Vol. is already considerably advanced, Mr C. having already finished his manuscript, so that the 2nd & 3rd. vols. will appear very nearly if not at the same moment.

Since I last wrote to you we have received at the Jardin du Roi many most valuable augmentations to the Zoological & Anatomical collections. We have just received 15 large boxes from the matrix made by Mr Cuvier's son[139] when with Sir S. Raffles, in which are 5 complete skeletons & 4 skins of the Sumatra Rhinoceros, a male & female Malayan Tapir (skeleton & skin), the Dugong, the Indian Buffalo, besides innumerable skeletons of Apes & other smaller animals. The collection of Birds is really magnificent, that of reptiles & fishes less numerous, so that the momentary loss of the collection seized by Sir S. Raffles has been amply made up by the zeal of those ['two' deleted] gentlemen.[140]

As to geology, little has been done here since my last letter. Brongniart will soon publish his paper on the Vicentin, with charming lithographic plates of the fossil shells of Rouen, which I am sure will please you. His work on Trilobites is also very near appearing; the plates are also in Lithography.

I am extremely sensible for [*sic*] the kind interest you have taken in my projects on India and am only sorry that there is so feeble prospects [*sic*] of their success. I must then content myself with my place of Assistant Surgeon there or accept employment elsewhere; this latter I would certainly prefer could I but get over the consent of my relations, and their express desire of my establishing myself in that part of the world. No where do my natural feelings turn to with more pleasure & prospect of success than to India, no where would I find more ample protection in my pursuits and labours than in the person of the Marquis of Hastings[141] who, passionately fond himself of Natural history in general & of Zoology in particular, could afford me more efficaceous means of rendering service to science, in [deletion] a country so interesting under every point of view & so immense in geographical extent; & so little known to Europe than the Governor General who is litterally [*sic*] the king of the country. I would be more specially placed in an advantageous position as I am intimately acquainted with his sister the Countess of Granard[142] who has already given me letters to Lord Hastings of the warmest nature.—I have also from the hand of Lady Hastings very warm recommendations to his niece, besides to other members of the family. It would, I am sure, be very nearly useless to think of going out to India as medical man and then think of neglecting my more immediate duty, by sacrificing it to my scientific pursuits, nor do I suppose such would be tolerated. I think I might be able to have the situation which was offered to me 4 months ago by a foreign government but, be assured, I have patriotism enough, perhaps in my case too much, to accept of anything of this kind before offering my services as home: as to your proposal of going to New South Wales, it is very tempting, being perhaps the amplest field of research ['for' deleted] in Zoology & geology, both my favourite pursuits. ['As to botany' deleted]. My ignorance of Botany you seem to fear might be some objection to my getting forward, but I presume that science is cultivated at success [*sic*] by the Medical people attached to the Establishments at Sydney & Port Jackson, & you know in what consists a travelling Botanist, he is almost a complete machine for collecting & drying plants which in his Cabinet he will hereafter describe, not like the Geologist or Zoologist, both of which, especially the former, must study in the field—and the latter in the interior of his animals, which cannot be done elsewhere than on the spot; besides the Botany of the Coasts of New Holland has been already investigated by several very great Naturalists (Brown,[143] Labillardière,[144] Gaimard[145]) whereas the Geology has been by none, & the Zoology by the sedentary Cabinet naturalists of England such as Pennant,[146] Shaw[147] & Latham;[148] the field in both those sciences . . . is immense, and, with little expense, great additions might be made to our national collections. If employed with 2 or 3 ['such' deleted] people under me I am confident that in a few years I could send home such collections as would astonish. I would propose to take with me a preparer of animals from Paris, who could be had for £150 a year and who could instruct others in his art; this would be the principal expense besides my own salary and a provision which I would require to be made for me hereafter.

I presume no man would have more in his power than Sir H. Davy:[149] as to Mr Giddy,[128] I knew him in Paris, and was as civil to him as possible. If you should see him you perhaps would speak to him. He will recollect me as having breakfasted with him at Cuvier's, and as having showed him through the Establishment in company with Cuvier & Humboldt.

I will remain in Paris until the 2nd week in December, so that I shall expect to hear from you—your plaster models are already packed up with my own and those of the British Museum, addressed to this latter—I shall send them to Calais as soon as I am recovered. I have written to Konig[150] to unpack them, and put aside your part, each specimen to which has your name written upon it—How is Leach? what do the[y] intend doing with his place at the Museum? Pray have the goodness to excuse me to Mr Conybeare for not executing his commissions sooner—but I shall not fail to bring the books he wishes to have with me when I go to England. I would be much obliged to you to send me 5 or 6 of your tabular view of the stratification of the British Isles, as several people have been asking me for it—I sent you by Mr Webb[129] a paper on the neighbourhood of Paris by M. Héricart de Montferrand.[151]

Mr Cuvier's own daughter is just recovering from a very severe attack of inflammation of the stomach—she is now well.

Adieu my Dear sir,
Believe me Ever,
Yours very sincerely,
J. B. Pentland

To Revd Professor Buckland,
Corpus College
Oxford, England

[Last paragraph written crossways on the first sheet]

I read in a Periodical of Scotch publication that a very large skeleton of a Whale has been found in a fossil state near Linlithgow, not far from Edinburgh, and that it is now placed in the Museum of the latter city.—As Cuvier intends treating of fossil Cetacea, he would be extremely obliged to you if, through Jameson[16] or any of your Edinburgh friends, you would procure him a drawing of it & especially of the head—knowing no person intimately enough himself.

XVIII Pencil date '3 Nov. 1821'

My Dear Mr Buckland,

I send you enclosed two Geological papers by Mr Prévost[125]—who begs me to present them to you with the letter—he is a young man who promises fair in the Geological career, especially as relates to the more Modern shelly beds. He is a pupil of Brongniart.

I am getting round slowly—although advised to go to the country—I cannot decide my self to separate from the Jardin du Roi—where I am always learning, and as I never shall have hereafter such an opportunity.

I learn that Mr de la Beche[37] has purchased at *Villers sur Mer*, 5 leagues from Honfleur, a series of 17 vertebrae of fossil Crocodile,—Mr Cuvier desires above all things to have a drawing of them, if Mr de la Beche does not intend publishing them himself—as Mr Cuvier has the jaws of ['the' deleted] an animal found nearly at the same period on the same spot, which probably belongs to the same specimen as the 17 vertebrae.

Your plaster casts shall in all probability be sent this week if I shall have time to finish packing them—I have got a copy of Cuvier's Work for Clift, it could not be better placed.—As to Miss Morland's copy, Cuvier has not spoken to me of it since—you know I could not ask him for it with propriety.—As to the copies of the Plates you shall have them in 10 days—I shall send 15 of each.—

I am now going to the opening of the Chambers to escort Madame Cuvier, so that I am obliged to close my letter ['resting' deleted], assuring you of being

ever Sincerely Yours,
Jos. B. Pentland

Jardin du Roi
Monday 3 Nov.
1821

Revd. Professor Buckland
Corpus College
Oxford

[Note in another hand (Buckland's ?)] Bone cement

XIX

My Dear Mr Buckland,

I have this moment received your very kind letter of Nov. 18th inst. and immediately communicated to Mr Cuvier the contents, who begged me to give him your letter and at the same time to write to you in all haste, to endeavour to procure for him some of the bones[152] found in such quantity in Yorkshire, either by exchange or by buying them, especially those of the Rhinoceros, Hippopotamus & Hyena. The quantity of this latter seems to be very great, and as Cuvier is now at that part of his work which treats of the Carnivorous animals, no present could be more acceptable to him, or more useful to science, since he would be able to compare them with all the known species, especially that discovered in Germany & in France. As to the Rhinoceros you will be particular in endeavouring to procure good specimens of the head so that in yr. paper you can positively determine if it be to the Siberian species (Rhinoceros Calirhinus)[153] that the Yorkshire one belongs. Neglect no bone or no atom of bone; bring away all you can find. It is a very interesting question to determine if the Hippopotamus of England & of Northern Latitudes is perfectly homologous to that of Italy—this you will easily determine if you find any specimens of the Head or of the long bones of the extremities, & bones of the Tarsus & Metatarsus & of the Carpus & Metacarpus—you being on the spot may be able to collect sufficient materials for the construction of Skeletons, and in case you do, I promise to go sooner to England than I intended and get them up for you.

In résumé collect all you can find, especially of the Hippopotamus, Rhinoceros, Hyaena & Elephant, as by so doing you will be able to render a service to Science and oblige your friends.

I am sorry to learn that Leach still continues so ill. I shall write to you at Oxford respecting my plans with regard to the British Museum.

In haste, Believe me Ever
sincerely yours
Joseph B. Pentland

Paris 24 Novr 1821

[originally addresses 'To the Revd. Professor Buckland' at Kirby Moorside, Yorks: redirected to 'Corpus College, Oxford' by another hand.]

XX

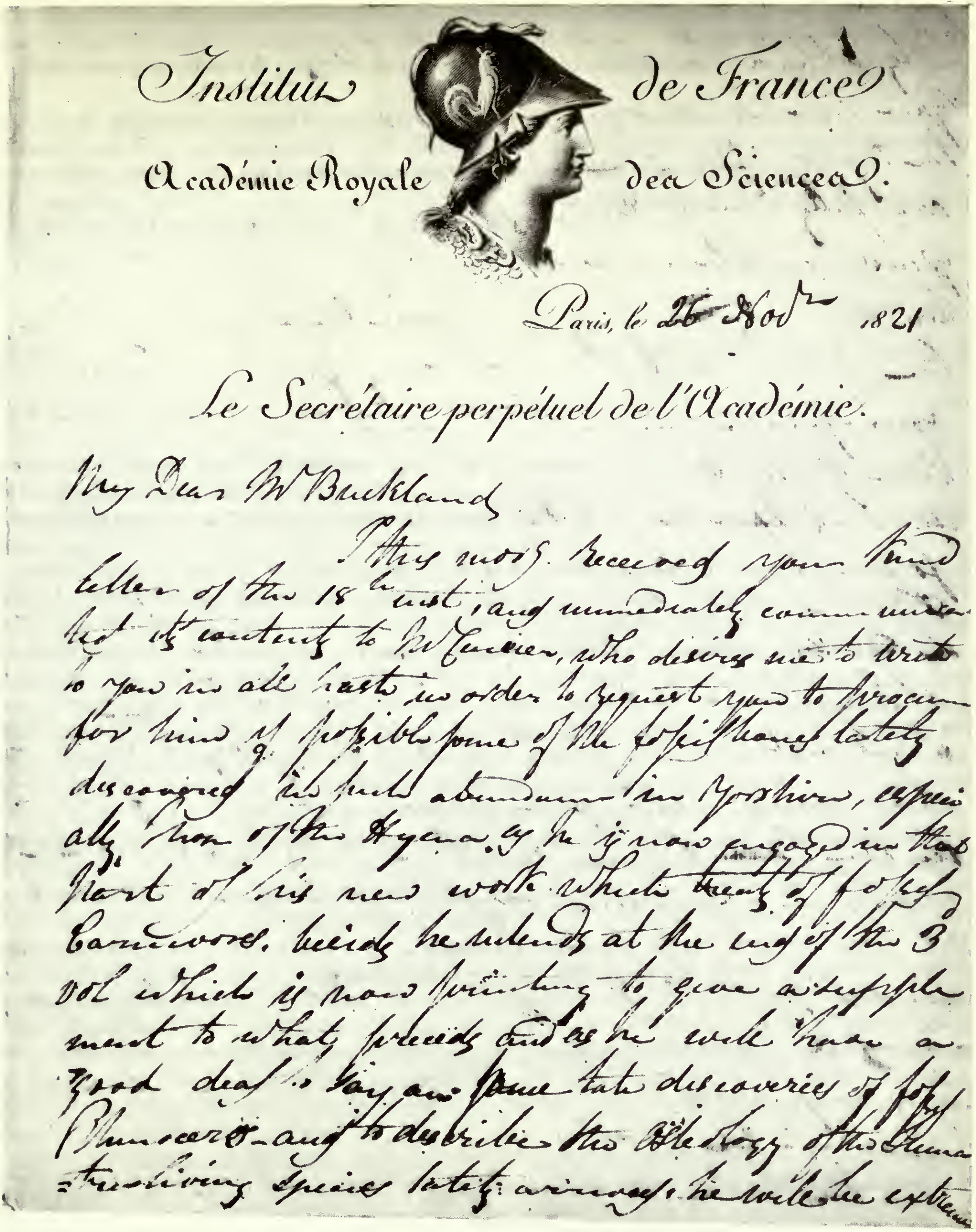
Institut de France
Academie Royale des Sciences

Paris, le 26 Novr. 1821

Le Secrétaire perpétuel de l'Academie

My Dear Mr Buckland,

I this morg. received your kind letter of the 18th inst., and immediately communicated its contents to Mr Cuvier, who desires me to write to you in all haste in order to request you to procure for him if possible some of the fossil bones lately discovered in such abundance in Yorkshire, especially those of the Hyena, as he is now engaged in that part of his new work which treats of fossil Carnivores. Besides he intends at the end of the 3 vol., which is now printing, to give a supplement to what precedes and, as he will have a good deal to say on some late discoveries of fossil Rhinoceros—and to describe the osteology of the Sumatra living species[154] lately arrived, he will be extremely obliged to you for any details or specimens you can send or lend him of the Rhinoceros or of the Hippopotamus. ['you' deleted] If you go to Yorkshire, examine carefully if any remains of the smaller species of the genus Mustela are found—or of the Glutton,[155] the only two animals wanting to complete the similarity between the Yorkshire Caverns & those of Gaylenreuth. As to your opinion that this is the first example of a mixture of the remains of Carnivores & Graminivorous Animals, you do not perhaps remember that the fossil species of Hyena discovered in Fauvent in France was accompanied with bones of Rhinoceros & Horses. Those latter were found with the bones of Elephant & Hyena in the celebrated depot of Canstadt in Wurtemberg [*sic*] and I myself last winter [1820] discovered teeth of a very large species of Wolf—in the ['Nice' deleted] Bone Breccia of Nice & Ceuta.—Those are the principal exceptions I recollect at this this moment.—Endeavour to procure good specimens of the long bones & of the Head of the Hippopotamus & Rhinoceros, in order to establish with certainty if they belong to the same species as those already known.—The most interesting question which you can thus resolve, is if the Hippopotamus of Yorkshire differs from that of Italy? and if the Rhinoceros resembles more to that of Siberia than to the Italian species.—As to the bones of the Stags, you will endeavour to procure portions of the Horns, the only parts on which one can pronounce with certainty.—The fossil species of Horse will perhaps present some specific differences (which have not as yet been perceived) when the head shall have been once found complete.—The Water rat of which you speak is in all probability very different from the Mus Aquaticus of Systematick [*sic*] authors.—I am very happy to hear that you intend paying a visit to Yorkshire—it is Mr Cuvier's sincere wish that you should do so, and he desires me to advise you to it in his name.—The Yorkshire Cavern[152] will now become no less celebrated than those of Gaylenreuth & Schartzfeld[156]—and the product is in your hands & may give origin to as interesting a work as those of Escher[83] & Rosenmüller.[157] I am confident Mr Cuvier will afford you every assistance in his power. I have written to you at Kirkdale in Yorkshire, in hopes you may hear from me when on the spot.—



Institut de France
Académie Royale des Sciences.

Paris, le 26 Novr 1821

Le Secrétaire perpétuel de l'Académie.

My Dear Mr Buckland

I this morng received your kind letter of the 18th inst, and immediately communicated its contents to Mr Cuvier, who desires me to write to you in all haste in order to request you to procure for him if possible some of the fossil bones lately discovered in such abundance in Yorkshire, especially those of the Hyena, as he is now engaged in that part of his new work which treats of fossil Carnivores. besides he intends at the end of the 3 vol which is now printing to give a supplement to what precedes and as he will have a good deal to say on some late discoveries of fossil Rhinoceros and to describe the Osteology of the Rhino=two living species lately arrived he will be extre

Facsimile of the first page of Pentland's letter of 26th November 1821. (Reproduced by courtesy of the Manuscripts Dept., University of Nottingham).

I am extremely sorry to hear of poor Leach. As to the Museum, if the thing is worth having and if I get my parents' consent,[158] my health continuing good [deletion], at Mr Cuvier's request, it is my intention to apply for it. I hope that you will exert yourself with your friends, and advise me how to proceed without being obliged to go England. Lord Granville[159] might ['give' deleted] be got to assist me with your interest.—I presume I shall run as fair a chance as another, and in case of not proceeding shall be able to console myself without difficulty.—Mr Cuvier will write to Mr Davy[160] on the subject.

Shall I send you the Metallic thermometer, it costs [blank space]. There is no pen portrait of Humboldt.

Excuse this official paper, it being the only one I could find at the moment of writing. Brongniart has already figured the Trilobites of which you sent him the drawings and from the same locality.

Could you procure [deletion] Mr Conybeare's paper on Ichtyosaurus for Cuvier, if not I shall give him that which Mr Conybeare sent me.

Ever Most Sincerely Yours,
J. B. Pentland

Jardin du Roi,
Novr. 26 1821

XXI Pencil date Dec. 3 1821)

My Dear Mr Buckland,

I wrote to you by last Courrier informing you of my intention to place myself in the list of Candidates for the British Museum in case the place was worth having. Before proceeding farther I request you to give me your advice on the subject. I am sorry you are already so far engaged for Mr Miller,[161] however I fear, poor man, he has a very poor chance, when in competition with Horsfield[162] & Stevens[77]—I have seen his work, it is not held here in great estimation. We have a Mr Orbigny,[163] most assiduous Naturalist, who is working on the same subject, but God knows when he will publish as he is as poor as a Church Mouse.

I wrote to you concerning the fossils lately found in Yorkshire in order that you might get some for Cuvier, who promised me a letter for you, but has been obliged to go to the King at the moment of writing it.

The casts of fossils left this 10 days ago for Calais, and are ere this I hope in London. Your pack is not in a separate box, but in a common one for the Hunterian & British Museum. I have written to Rouse[164] & Clift in order that they be sent to Oxford as soon as possible—I did not receive yr. letter wishing to have them put up separately until last Friday.

Give me any advice you can relative to the British Museum, the footing the Keeper is placed on, the Emoluments, as to the duties they are very great.

I am getting better, and will soon be as well as Ever.
Believe Ever sincerely
Yours
J. B. Pentland

Jardin du Roi Postmark
Decr. 3 1821 Dec. 10 1821
To the Rev. Wm Buckland F.R.S./Corpus College/Oxford

XXII [Pencil date 'Dec. 3. 1821']

My Dear Mr Buckland,

I have just time to say a word to you. Mr Cuvier desires me to say that you may have the casts directly of a part of yr. fossils, so if you will, you may have them sent immediately. Let me know what you wish.

Would you wish to have some specimens of the Freshwater Limestone in which the Palaeotherium has been discovered near Strasbourg and in the South of France—I can send them to you.

Do you think which [*sic*] wd. be better, to send a cast of the Palaeotherium's head to the British Museum or the Hunterian collection, as we intend sending one and wish to know in what publick [*sic*] collection it wd. be more usefully placed.

When Mr Conybeare's paper appears, will you let me have a look at it, as no body here gets the Geological Transactions until long after their publication.

Mr Cuvier, Brongniart & Cordier give their best regards to you.

Believe me in Haste
Yrs. Sincerely,
J. B. Pentland

Have you received yr. diploma of Correspondant,[165] it was sent 15 days ago to Mr Macleay.

Professor Buckland
Corpus College
Oxford

XXIII Paris 7 Decr. 1822 [should read '1821']

My Dear Mr Buckland,

Mr Cuvier desires me to thank you in his name for yr. kind attention in procuring for him Mr Miller's Work[166] which he has only received this morg. [morning] with Mr Conybeare's paper. I will write by next courier to Mr Conybeare. I have not had time to peruse Miller's work but shall this Evg. [evening] and will write to you my opinion on the subject. I fear his ideas on Mr Cuvier's classification of the Encronites [*sic*: should read 'Encrinites'] caput medusas [*sic*] are not well founded.

Mr Prévost has just read a very interesting paper at the Institute on the horizontal Strata of the N.N.W. coast of France from the mouth of the Somme to the inclined or Transition Strata of Brittany—he has identified the different Strata with those of England after your table & Greenough's map—and I am sure you will be pleased with it, I shall send it to you as soon as published.—He finds that the Strata which contains [*sic*] the Honfleur Crocodile corresponds to your Purbeck beds or thereabouts and that it is separated from the Lias which contains the Ichtyosaurus & Gryphaea *incurva*[167] with Pyrites—by the entire mass of the oolitic formations which forms [*sic*] the Caen building stone—and which near this latter town passes to the coral rag & the other members of the oolitic formation.—The bed which contains the Honfleur Crocodile is principally characterised by a small species of Oysters or Gryphites which Lamarck[168] describes under the name of Gryphaea Augusta[169]—this shell frequently adheres to the bones of Crocodiles.—In different parts of the basse Normandy this shell becomes so frequent that the entire rock appears made up with them and is then called *Lumacheles* [*sic*: more usually 'lumachelles']. It is also found near Boulogne sur mer. In all the French strata, salt or gypsum does not appear in the horizontal strata and with the Lias or a bed which may perhaps represent the Magnesium Limestone, if it did not differ so strikingly in stratification from the red sand on which it reposes—the inclined strata follow to the Lias & are composed of sienite [?] Porphyry (rare) & red sandstone which appears ever superior to the two former, so as to authorise the supposition that these beds have been thrown out of their natural position so considerably as to get even beyond the vertical direction, supposition which Cordier has lately held out to explain those anomalies of position described [HOLE IN LETTER: prob. 'by'] Brongniart as the Italian Eupholid [?] &c [HOLE IN LETTER].

Very little new in fossils, except that we have just received the 3 metatarsal bones—the Atlas and cubitus [?] of a very large species of Rhinoceros from the environs of Abbéville which we have every reason to believe belongs to the Rhinoceros Incisirus Cu., Lately discovered near Orleans, and of which I shall send you casts of the incisors & of some of its molars.—By the bye, have you received the casts of fossils I sent to home [?] 5 weeks ago—I write to Konig by this courrier on the subject. Have you been to Yorkshire, and what has been the result of yr. voyage—Mr Cuvier hopes you will not have forgotten him. We have just discovered at M.Martre [Montmartre] a new animal of the genus Viverra, more nearly allied to the Javanese & Madagascar species than to any other living ones, but very different in many respects from both. Any news about the museum? My memorial will be presented shortly to the Archbishop[170]—Davy has written a polite letter to Cuvier on the subject—and as Muller[161] is a German, I have every reason to suppose that an Englishman & a native will be preferred to a foreigner—if his grace[171] [*sic*] does not wish to make the Museum an ['reception house' deleted] Asylum for ['foreigners' half deleted] Germans & such.

Ever sincerely yrs.
J. B. Pentland

To the Revd. Professor Buckland F.R.S./Corpus College/Oxford/England

Postmark
Ja. 11 1822

XXIV

Jardin du Roi
10th Decr. 1821

My Dear Sir,

I wrote to you by last courrier, but hearing that an accident had happened to the Courrier of the Mail, I beg to trouble you again on the same subject, the nomination of a person in place of our poor friend Leach. As long as any chance of his recovery existed and as long as the Trustees of the Museum did not declare his place vacant, I desisted from speaking of my intention to apply for that situation, but now since it seems decided that he can no longer take upon him the duties of his office, by the vacancy being declared, I cannot allow such an opportunity [to] pass without exerting myself to procure [it]. In so doing I am seconded by my best of friends, Mr Cuvier & family, who ever since poor Leach's illness have not ceased to urge me to demand his place. Mr Cuvier does it with this good intention, that the British Museum & the Jardin du Roi may form two great national members of the same family, by forming a correspondance, and by establishing exchanges which will undoubtedly be to our advantage. As I know the collections of the Jardin du Roi as well as any person here, and certainly better than any one in Gt. Britain, I would be placed in a more favourable position for thus serving the British Museum than any other applicant who might obtain it, and thus be able to raise in a short period of time, with proper encouragement on the part of the Trustees and of zeal on my own, a monument no less glorious ['than' deleted] and useful to my country, than Mr Cuvier has formed in 20 years, the greater part in time of War, at the Jardin du Roi & which, while it serves as a most interesting scientific monument for strangers, shows an unhappy contrast when compared to the British Museum.—Placed as I have been during 5 years in France, 3 of which constantly spent in the Jardin du Roi, in the laboratory of Mr Cuvier, enjoying every facility of acquiring instruction, the keys of the Museum placed at my disposition, with the most unlimited permission of making use of them.—During those three years I have not ceased to work, especially occupied with Comparative Anatomy, the superb collection of Cuvier constantly under my eyes, numerous dissections of animals of all those which died during that period at the Menagerie, and above all the immense advantage which I have reaped from the conversation of Mr Cuvier, in whose home I have been ever received as one of the family.—Add to this that the immense number of drawings formed by Cuvier and Laurillard has been placed at my disposition with [deletion] all the manuscript notes destined to form the great work on Comparative Anatomy of Mr Cuvier. In fine, Anatomy, which should form the basis of Zoology, and Zoology itself have formed the most essential part of my education, and certainly that which is of most importance for the place at the British Museum: not considering as an advantage (if you please) my correspondance with the Jardin du Roi.—The opening that now exists in London for a comparative Anatomist is now very great, as Sir E. Home is going off.[172]—For a Zoologist the opening is no less advantageous.—As to the Candidates for the situation, I without self-conceit may say that not one of them appears to me adequate for the Task—at the Museum, General Zoology is the object, where a single person is charged with the care of the entire Animal Kingdom.—Swainson[173] is a very poor Ornithologist & Entomologist & does not see beyond specific distribution, and his Brazilian Birds: Dr Horsfield[162] appears exclusively ornithologist & that only of Java, his learning does not seem to extend even to the 3 other classes of Vertebrate Animals.—Stevens[174] is exclusively entomologist. As to Miller[161] I do not know upon what he is strongest.—I repeat a man cannot think of learning

Natural History on his entering into the care of a collection: he must be familiar with his subject and especially have seen what is order and arrangement [deletion], without which Zoology is not a science.

As to the Administration & Expenses of such a collection, my long residence at the Jardin du Roi ['allows' deleted] permits me to form an Estimate that the same thing could be done in England for very nearly the same sum as in France. I have taken a long series of notes on the subject, which I could submit to the Trustees if you thought it would be of any use.

The Jardin du Roi receives annually £12,000 Sterling, which is divided into three parts: the Botanical, Mineralogical-Agricultural & Zoological Departments.—Out of this latter the collections of Comparative Anatomy, the Cabinet d'Histoire Naturelle & the Menagerie is supported, Menagerie which contains more living animals than any other in Europe. Add to this that out of the same £12,000—13 Professors and 13 and [*sic*] naturalists are paid upwards of £3,800 Sterling, that the Buildings of the Establishment are repaired &c. You will find that in France the Zoological collection does not cost more than [gap] and, if you examine on what those expenses rest it will be found that they are [deletion] such that in England they would not exceed what they do in France. I am certain that with 3 or 4 thousand pounds a year the Zoological collection of the British Museum would be brought up to a level with that of Paris and that, with & included in the same sum, such a collection of comparative anatomy might be set up as would be essential to the study of Zoology in all its departments, and to the study of fossils particularly; but, for that, a person must be placed at the head who is perfectly conversant with the managing of such an institution—which, as I said before, none of your 4 Candidates can have been. As the French say, en résumé my principal recommendations in applying for this situation are 5 years' residence on the continent actively dedicated to the study of the different branches of Natural Sciences & the last 3½ years constantly employed in the Zoological & Anatomical Departments of the Jardin du Roi (which exceed undoubtedly everything of the kind in Europe), enjoying such facilities as few others have ever been permitted, and placed under the eye of the first Naturalist & Anatomist existing, whose house, Library, Drawings & manuscripts have been at all times open to me: and whose advise [*sic*] has been always given & profited of by me. Add to this the advantage which would result to the British Museum by my knowledge of that of the Jardin du Roi, and the correspondances and exchanges which might thus pass between those two great National Institutions: such are my recommendations and such do I submit them to you, well knowing that you will forward my views as far as is in your power. How much would I be gratified to be established in London, where so wide a field is open and where we might (you and I) render such a service to Zoology & Geology by the description of those fossil Animals which are so abundant in the British Isles. I am sure nothing would be wanting to such an undertaking, as Mr Cuvier would lend for any period to me the objects contained in the Jardin du Roi, so that by those means we might be independant [*sic*] of the other collections of London, which jealousy might shut ['up' deleted] against [us]. If I should succeed in obtaining this situation I sincerely propose such an undertaking to you; my anatomical knowledge on the subject might throw considerable light on the Geology of the British Isles when combined with your Geological observations.—Such an undertaking, with your name affixed to it, could not fail to meet with success.—

My place in India is definitely settled. As I could not procure a nomination to Bengal, I have decided to give my demission—which accompanies this letter today. I have no idea of what I shall do in case I fail in procuring the place at the Museum. I will probably be obliged to accept a situation under some foreign government.

I shall remain in Paris until I hear from you. Mr Cuvier has written to Sir H. Davy a very warm letter in my favour—you will have the kindness to speak with Sir H. on the subject.

I am very anxious to see how this business will terminate. Adieu My Dear Mr Buckland, write by post and do not wait for the Courrier.

Believe Me Ever
Most sincerely
Yours J. B. Pentland

Paris 10 Dec. 1821

Excuse the style of this letter, which has been written in a great hurry.

XXV Paris 17 Dber 1821

My Dear Sir,

I have this moment received your kind letter of the 4 inst. and am extremely sorry to learn thereby that you can be of no use to me in the application to succeed poor Leach. I may now say that I have nothing to depend upon but my own merit and, such as it is, I am determined to push it as far as in my power, because I see that in case the Museum be filled as you desire, the institution must necessarily be placed in the hands of people who can have few pretensions to the title of Naturalist and still less to that of a curator or Conservator of the first National Museum of the Empire. I am fully determined to employ every means in my power to obtain the situation I repeat, and that nothing may occur in my India views which might be contrary to my interest on the present occasion, I have written to my friends to say that I have relinquished for ever going to India since I found it impossible to obtain a nomination else where than at Madras. I am then thrown upon the world & must needs endeavour to find a permanent situation, if possible. The British Museum presents such a one at the moment, and my reasons for not applying sooner were of a double nature, first my repugnance to apply for the position of *a friend* when still alive, and when hopes might still be held out of his recovery, and secondly my wish to get out to India and the Bengal Establishment, which as I said before has failed and has caused me to relinquish my views in that quarter of the globe. I presume that the opinion of the President of the Royal Society will be of great weight on such an occasion; Mr Cuvier has written to him the warmest of letters in my favour, the copy of which I subjoin that you may see the opinion that this great man has of my talents, of the utility which my services would be to the Museum, and his conviction that no person could fill the place with more interest to the institution and to science then myself. If I shall not succeed, it will not be owing to my ignorance of the duties of that office, which I fear few persons in England are perfectly conversant with since Leach's death. As to your opinion that science would benefit more from my residence in the East than in Europe, I am not entirely of the same ['op' deleted]. I hope that wherever [HOLE IN LETTER: missing words probably 'I may be'] placed my labours may be useful, but in no country is so [HOLE IN LETTER: should probably read: 'well endowed . . .'] as that which offers the Capital of Great Britain. It is a shame to the Nation that its National collection is not really superior to that of the smallest German Prince, when we look at the resources which the colonies & relations of Great Britain present—and you, I am sure, are well convinced that, in the number of Candidates [deletion], supposing them good and professed Naturalists and men conversant with the collateral branches of Natural and Physical sciences, which none of those gentlemen are), not one will employ more activity than did our poor friend Leach, and it is to be feared that what he has done will soon be effaced, and that the Zoological department of the British Museum will fall into the same state that as it was in Dr Shaw's[175] lifetime—in the hands of persons whose education & stock of knowledge does not permit them to appreciate it.—The arrangements of Birds & Insects is the duty of the Conservator of the Museum, I grant, and like every other thing of the kind it may be done in different manners: on that arrangement depends the merit of Naturalist and the science of the thing if I may use the expression, and if I wanted an example in favour of my assertion, I would bring forward the comparative labours of two great Naturalists of the last century Linnaeus and Pallas,[176] and ask which of the two have rendered the greatest service to science—but My Dear Sir we must not judge from what has hitherto passed in the Museum, for although Leach rendered a great service to the Museum, he also respected too much the routine established by his predecessor,[175] who unfortunately looked too much on his place as a sinecure.—With activity, knowledge, and a love of science, I repeat, the British Museum, in very few years, could under a proper person be placed on a respectable footing—and before long rivalize [*sic*] even the most celebrated of the kind in Europe. What an honor to the country and what a service to science, might not the British Museum offer in a short time. I am confident that Mr Miller, who has never seen what a collection of Zoology is, will find himself embarrassed on entering the Museum.—I am sorry that he is your protégé, not I assure you on my own account, but on your own for having recommended a man so unfit for the situation to all appearances. I do not [HOLE IN LETTER: missing words probably 'seek to'] solicit your interest, knowing that you have already promised it to another. But I will ask, as a man conversant with science, to which of the Candidates would you give your note as a Trustee of the Museum? to a person conversant with the subject or to one who is not? With this question I shall close my letter, and shall for the last time speak to you on the subject—as you can no longer be of any use to me.[177]

Mr Cuvier's letter to Mr H. Davy ['Bart, F.R.S.' deleted] I presume will be extremely useful. I would have sent you a copy of it but I suppose you will see it in London; I will only cite one phrase which is 'il est de tous ceux qui je connais celui [deletion] qui possède le mieux les principales branches de la Zoologie'[178] and farther on 'est un moyen presque sur de vous rattrapper dans un[e] carrière ou nous vous avons jusqu'ici dépassé.'[179]

I have learned that the bag of Plasters [HOLE IN LETTER: probably 'sent'] for you, the B. [British] Museum and the College of Surgeons left Calais 10 days ago, and thus they should be arrived in London.—Mr Ricketts[117] is now here, he presses me much to go to India. He has been extremely civil to me & in return, I have introduced him to all the scientific people here.

Mr Cuvier has received yr. letter with the drawing[180] of Mr de la Beche; but has not yet heard of Mr Miller's book[166] which you say you sent him. Perhaps they will arrive today by the courrier.

Ever sincerely yours,
J. B. Pentland

To the Revd. Professor Buckland, F.R.S.
Corpus College, Oxford

Date apparently De 21 1821

XXVI

Paris 24 Dec. 1821
Jardin du Roi

My Dear Sir,

I am extremely obliged to you for the kind information respecting the application for the place at the Museum contained in your letter of the 12th inst. I shall act as you advise and send certificates & my memorial to the Archbishop of Canterbury.

I am uneasy at not hearing from you or Konig relative to the Casts which were embarked more than a fortnight ago at Calais for the Port of London addressed *to the Trustees of the British Museum*: by this time they must be either arrived or lost, I am sure you will be highly pleased with them. In the course of a month the second part of this collection will be ready & shall be immediately sent; it will consist in a molaris of the Mastodon Angustidens lately discovered in the neighbourhood of Orléans, the molaris of the Gigantic Tapir from the same locality, the Radius & cubitus [?] of ['the' deleted] three different species of Palaeotherium, and the metatarsal bones of 4 species of the same genus, in order to show the great differences which exist between those animals of the Antidiluvian [*sic*] worlds—the radius & forefoot complete of the Anoplotherium commune, as well as many other interesting specimens: in fact I am now charged by Cuvier with the entire direction of the Casting, and nothing worthy of notice shall escape me.

I enclose you a note of young Brongniart which he and his father request me to present to you. I am sure your love for science will cause you to do everything in your power towards the advancement of his views. If any other recommendation was wanting than that of the author of the *Géographie minéralogique des environs de Paris*, I should feel myself no hesitation in giving it.

Brongniart is busy working at the environs of Paris for Cuvier's second vol., which [will] not appear, owing to Brongniart's slowness, until the end of February when the 3*rd* will also appear & the greater part of the 4th shall be printed—After this Brongniart intends to give a complete history of the Jura Limestone with plates of all the fossils as well as those of the other secondary strata—he has brought the Lithography to great perfection for fossils, as you will see in his paper on the environs of Paris, in which he has figured all the fossils of the Chalk formations, from every country where this latter is known. He considers with you the Diableretz near Geneva & the Montagne du Fils as Chalk, instead of that indefinable Alpen Kalk of Humboldt: you will be astonished to see the inferences (extremely just) which he draws from the identity of the fossil organic remains of this formation.

Mr Cuvier has received a letter from Davy relative to his application for me to succeed Leach. He promises to do everything in his power, but nothing gives me more hope than yr. opinion that the Archbishop will give [HOLE IN LETTER: 'the'] situation to the best qualified, in which case I run a fair chance of success. However in case of not succeeding, it is almost settled with my relations that I should establish myself in London: having relinquished my views on London I am heartily sorry that giddiness on my part lost me yours & Mr Conybeare's interest,[181] but I hope that our friendship will never be broken of[f] for such a cause, in which, if there is a defaulter, I must confess that it is myself: however you in return will not take umbrage at my opposing your friend as far as lies in my power.

We have received Clift's cast of the Ichtyosaurus which is most beautiful. He is now making drawings for Cuvier of the fossil bones of Hyena from the Yorkshire cavern, but hopes that the gentleman to whom the specimens belong will lend them to Cuvier in a short time, after publick curiosity has a little abated. However as you going on the spot[182] you will be able to find others, a part of which you perhaps could send here.

Cuvier & family desire their best respects to you. I have subscribed for Mr Conybeare,[183] but propose to wait until the 2nd vol. is published in order to save expense & trouble, ten to one I shall be in London before a month.

Ever sincerely yours
Joseph B. Pentland

Jardin du Roi
Monday morg. [Morning] 24 Dec.
To
the Rev. Professor Buckland
Corpus College/Oxford/England

Postmark
De 29 1821

XXVII [Incomplete letter]

. . . both living and fossil—I presume Home will have a quarrel with you if you take up this which he considers as his property—as I have heard he has been very much piqued at Mr Conybeare's paper on the Ichtyosaurus.

Since my last letter no new discoveries have been made in this country, if I except a few remains of Rhinoceros & Mastodon in the South of France & a number of fossil bones for Birds belonging to the genus Ardea (Bittern-Heron, Stork), mixed with innumerable land Helices, in the Freshwater Limestone of Bul de Chateau 5 leagues from Clermont on Auvergne.

Cuvier's second volume has not yet appeared. Brongniart has not yet finished his article [HOLE IN LETTER: should read 'on'] the Fresh water formations.

I have not heard anything of my application for the British Museum. I will send my memorial to the Archbishop next Monday, having been prevented from doing it sooner by a continuance of Bad health—I wrote to Mr Conybeare by last Courrier begging him to excuse my neglect in not answering sooner his last polite letter ['I hope to' deleted] at the same time returned him Mr Cuvier's thanks for his pamphlet on Ichtyosaurus which arrived with Miller's Book only a fortnight ago. I did not write to you by last Courrier Supposing you still *en voyage*.[184]

Believe me Ever sincerely yours
J. B. Pentland

To
the Revd. Professor Buckland F.R.S./Corpus College/Oxford

Postmark Ja. 25 1822

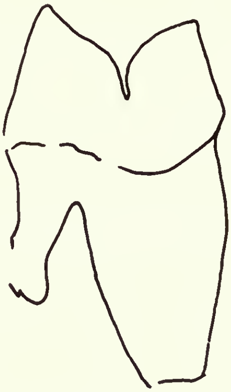
XXVIII

My Dear Mr Buckland,

I received your very kind letter with that of Mr Conybeare, and shall answer this letter as soon as I can possibly find time. Since I last had the pleasure of writing to you, I am sorry to say my health has been considerably worse than heretofore: my bowel complaint has continued to increase, and I now write to London to be permitted to remain here 6 months longer, and to go travel into Italy with a friend ['of' deleted] who will pay my expenses—this friend you know, it is Mr Ricketts, late member of the Supreme Council of Bengal, and nephew to Lord Liverpool.[185]

I beg of you not to mention this to any person whatsoever—as Mr R.[186] wishes it so—not even to your most intimate friends.—I need not tell you of what importance this trip will be to me in a scientific point of view, & on the other hand Mr Ricketts' interest with the Government & especially with the East India Company, in case of my being obliged to go out to India at any future period, in case of my not succeeding at [words missing]. Through him I expect to have Lord Liverpool's interest with the Archbishop of Canterbury.

You seem to have misunderstood what I said in my last letter on the Tiger's tooth of the Yorkshire Cavern; it is the inferior & posterior, and not the posterior superior. I am sure that Clifft [*sic*] could not have committed such an error in his drawing as to deceive us; however, to ['be' deleted] leave no difficulty on the subject, I subjoin a copy of the original drawing, which if correct is, as I said before, the inferior and posterior grinder of a Felis, surpassing in size that of the largest Bengal Tiger.



Your story of the Hyena's excrement in a fossil state has caused no less surprise here than in London. I hope you will be able to spare a part of your stock for the Museum here—Album grocum fossil!—

Webb's[129] expedition to Spitzbergen astonishes me not a little—I am so much afraid of cold that I would much rather go to the deserts of Arabia to be burned alive, than to the icy seas.—Do you think that Mr Trevelyan[187] & Webb would have any objection to allow a naturalist from the Jardin du Roy [*sic*] to accompany them—they might arrange so that he would prepare all objects of natural history for them, on their allowing him 1/2 for his pains.—I am sure Cuvier would would [*sic*] be very much pleased at all events to recommend to them to bring to us the skeleton of a Walruss [*sic*], the skins & heads of the different species of Seals, as without the head it is utterly impossible to distinguish the species.—I shall write to you further on the subject before my departure.

I expect to leave this [city] from the 1st to the 5th of March and shall be much obliged to you for any letters of introduction you can send me or procure for me for different parts of Italy—or any commands you may have.—Our route [*sic*] will be through Turin, Geneva, Plaiscenza [sic],[188] Parma, Bologna, Florence, Perugia, Rome, Civita Vecchia, Naples [HOLE IN LETTER—word missing probably 'Leghorn'], Pisa, Ferrara, Venice, Verona, Vicenza, Mantua, Milan, Pavia—& different parts of Switzerland.

Believe Me Ever sincerely Yours,
J. B. Pentland

Jardin du Roi
10 Feb. 1822

N.B. We have just received the whole anterior extremity of the fossil Rhinoceros—discovered last week at Abbéville with Tigers (a tooth), Elephants, & fossil Stag. The bones are admirably preserved.

The Revd. Professor Buckland
Corpus College,
Oxford
J. B. Pentland

Care of Mr Macleay Esq.

XXIX

Paris 25th Feby. 1822

My Dear Mr Buckland,

Brongniart has this moment sent me his new work on Trilobites[189] for you, which I shall send by the Courrier if possible, if not I shall send it by Dr Saddli, Professor of Chemistry at Florence,[190] who leaves here tomorrow (Tuesday) for London and to whom I have, at Cuvier & Brongniart's request, given a letter of introduction for you. I shall request him to give it to Clift who will send it to you with the least possible delay.—You will see by this work to what perfection Lithography has been brought here, as to fossil shells nothing can be more beautiful or correct than the Lithographic plate of the fossils of the Chalk formation, a copy of which I shall send you. Brongniart is completely of your opinion on the Black Limestone of Diableretz, Montagnes des Fils &c as belonging to the chalk formation.

I would have desired to send by Dr Saddli the 2 & 3 vols of Cuvier's work, which will not appear before the end of this month—I shall charge Royer[191] to send them as soon as published—with the Copy which Mr Conybeare desired me to purchase for him. Mr Conybeare can transmit either before or after the [deletion] amount to Royer. I shall also desire him to send at the same time Brongniart's fossil Crustacea, which I presume he will desire to have, which costs 15f. & Savigny's *Animaux sans vertèbres*,[192] which he requested me to send him some time ago—the amount will be 6-16-6d. Sterlg. or 165 francs.

We have nothing very new here. At Abbéville they are searching after the head of the Rhinoceros, the greater portion of whose skeleton has been found in the same pit, but unfortunately only a small portion has escaped the merciless pick of the Quarry men.—When the pit in which those bones were found [was opened]—the stench was so great that for some time the workmen were obliged to desist.—The sand which envellopped [*sic*] them is strongly agglutinated by the animal matter, and the odour was, according to the workmen, quite as disagreeable as that of putrid animal matter.—This is another proof of the very recent period at which those animals were destroyed, and comes very à propos in confirmation of your conclusion on your Yorkshire den. In the same pit were found the forms of the fossil species of deer similar to that of Breugues and in all probability of Yorkshire & other localities of Rhinoceros. Mr Treullin [?], an intelligent man at Abbéville,[193] writes that he has little doubt of soon coming upon the head. [This] will be an interesting a [*sic*] discovery, as from the bones which we already have there is every reason to suppose that this Rhinoceros differs from the Siberian species[194] & resembles to that which has been found lately near Orleans, furnished with large incisors like the living ones beyond the Ganges.

I wrote to you respecting any bones of fossil reptiles which you might not intend publishing & which you could send drawings of to Mr Cuvier. I must now make a similar request for those of Carnivorous Animals—have you any well preserved specimens of Hyaenas or Gluttons from the Caves of Franconia, or any of the Glires of Oeningen—your fossil jaw of Didelphis,[195] has it been found to a certainty in the Oolite beds? I doubt it very much as the appearance of Mammalia is of an infinitely more recent date—examine the locality if you possibly can, as we have an animal of the same genus in our Parisian gypsum with the Palaeotherium &c.

I await anxiously my permission from England to start for Italy—in case of receiving it this Week I shall start about the 12th of next month. I will be obliged to you by giving me any indications of the northern parts of Italy—any letters which you may send I beg you to address them to Cuvier's care, who knows all my movements and will forward them accordingly. I shall write to you from time to time, as well as to Mr Conybeare who I regret much not to have known personally—but with whose correspondence I have been delighted; I have not been able to let him keep the head of Iguana which I sent last Monday—for a long time—but before my departure I shall send you a beautiful head of a very large Monitor and which I will allow you to keep until my arrival in England. I must only request that my name shall not be mentioned in the course of your mutual researches.—I hope that you will publish (as soon as you have got over your Yorkshire Den) the descriptions & figures of the monstrous beast which you found in Lincolnshire.[196] Cuvier desires it much, and nothing could be more interesting. By publishing it in the

Philosophical Transactions you will be able to have good engravings made of it, copies of which I bespeak.

Endeavour to forward (if possible) proofs of the Plates of Mr Young's[197] book on Yorkshire,[198] of which you spoke in your last letter, in case of the work not being published shortly, as in this case Cuvier can make use of them by citing them in his 4th vol. which will be of considerable advantage to Mr Young's book. He will do the same for your paper on Yorkshire, copies of the Plates of which I expect daily from Clift.

I have not heard anything of late concerning Leach or his place as the Museum. I have not yet made any application, the reason for which is that Leach is now getting better (apparently); his place to my knowledge is not yet declared Vacant, and the laws of friendship & of delicacy which I owe to Leach do not allow me to apply as yet—as soon as I shall have heard of the Vacancy being declared I shall apply but not until then. To judge after the list of Candidates Great Britain is in a poor state as regards Zoology—your two best candidates (at least those which stand the best chance of succeeding) are foreigners—Mr Harker's[199] application is really ridiculous. Zoology is a very difficult study and if Mr H. judges from Botany he will be wonderfully mistaken—the Zoologist must be anatomist; [word deleted] Botany is what Mineralogy has been in the German school, a science of external characters. I must say I do not flatter myself with strong hopes of success, in a country where personal interest goes farther than personal talent, although you seem to think that the Archbishop will give the place to the person who best deserves it.—All my friends here, and especially Cuvier, look forward however with the strongest hopes, and I must say that no personal motives interest him—this is to my *amour propre* no small flattery and in case of my non success will serve to console me for the time lost in solliciting [*sic*].

Believe me Ever
Most sincerely yours
J. B. Pentland

Jardin du Roi
To
the Rev. Professor Buckland/F.R.S./Corpus College/Oxford

Postmark
March 4 1822

XXX

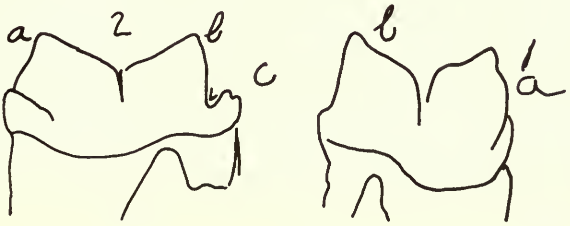
Paris 4 March 1822
Jardin du Roi

My Dear Mr Buckland,

I received yesterday your letters of the 22 & 25 inst,—with the box containing the teeth & album grocum of the Hyaena—for which Cuvier desires me to return you his best thanks.—All those teeth belong decidedly to the Hyaena, something smaller than in that which we have from Gaylenreuth, although belonging evidently to the same species.

I still insist on the presence of a Felis in your Kirkdale Cavern if Clift's drawings be exact—and I am certain that he could not have committed so great an error in two drawings of the same object as to have omitted to mark the talon on the posterior part of the posterior inferior molar, the absence of which in the Cat tribe distinguishes those animals from the Hyaena. I send you a comparative sketch of Clift's (1) drawing and of one of your hyaena's teeth (2). You see that in the genus Felis this tooth consists in two portions a.b. whereas there is a *third* portion or Talon—c., in the Hyaenas—as in the genus Mustela.—Now I repeat there is not a trace of the talon in Clift's drawing—and thus our dispute is reduced to this—whether Clift's drawings are exact or not.

left outside
hyaena's tooth



right outside
tooth of Felis

There is another character which is decisive in the relative proportions of the portions a & b. In the Hyaena the anterior portion a. is considerably larger than the posterior one, in the Felis tribe the posterior b. is the largest.—In fine if Clift's drawings is [*sic*] exact I will answer on *my head*, that the tooth in question is *that of a Felis*.—The discovery of the bear's jaw is wonderfully interesting. To which of the fossil species does it belong?—I am sorry to say that we have not at present a living Cape Hyaena (Canis Crocuta)[200] and our Canis Hyaena[201] is so very old & Paralytic that we are obliged to feed her on flesh—so that I cannot execute your commission.—In speaking of Hyaenas, perhaps you are aware that Mr Temminck[202] has published a paper on what it he calls l'Hyène varié. I have just received the head of this animal from Amsterdam. I find that if ['belongs' deleted] is a species of Dog & not an Hyaena. I intend to give a portion of the Album Grocum to Mr Vauquelin[203] to analyze.—Has Woolaston [*sic*][204] made a quantitative or numerical analysis of this substance?

I enclose you a short instruction that Cuvier desires for you during your Orkney tour. I beg you to send a copy of it to Webb,[129] as you will find few of the objects ['there' deleted] in yr. tour & as he may meet with the greater number of them.

I am very glad to find that you will have no objection to continue our correspondence, the best plan will be to send your letter to the foreign office to Mr Macleay, who takes care to direct them to me to the care of our Minister at Naples—['Rome' deleted] Florence &c. to Mr Rickett's care. I send you our route, with the last day which I shall remain in each town: I will not promise to be quite as exact as I have been hitherto, however you may depend that I shall do everything in my power. I shall have only besides yourself one correspondent, which is Mr Cuvier's family.—I intend leaving Paris on Thursday 7 of March, but as I intend to stop sometime at Lyons & Geneva, I request you to write to me as usual to Royer's[191] care, since my servant will not leave Paris until 8 days after my departure—so that he will bring any letters on, and if you possibly can send me on a few copies of your paper on the Alps—I have 5 of your British Strata which I shall distribute in Italy.—I beg you to let me know if I can procure any thing for you in Italy—I collect nothing for myself. My first attention shall be directed towards Cuvier—whatever else I can collect shall be at my friends' disposition, and you will undoubtedly come under this class.—Write to me at Naples—it is not improbable that we shall visit Sicily and that this excursion will last 3 months, it depends entirely on the tranquil State of the Country.—

I have directed that the remaining part of the Plaster Casts should be sent as soon as finished.—This second collection is still superior in execution to the first one in point of execution [*sic*]. I have sent Clift a copy of the Catalogue, which I have requested him to send you.—Present my best respects to Daubeny[62] & to Mr Conybeare &

Believe me Ever Most Sincerely
Yours, J. B. Pentland

(See next page for Plan of route)

In going
Mount Cenis
Turin 23 March
Piacenza
Parma
Bologna
Tinola
Rimini
Pesaro
Ancona
Rome *7 April
Naples 7 May
*I shall only stop a few
days in Rome in going but
shall remain a month
on my return

returning
Naples
Rome 10 June
Civita Vecchia
Florence 6 July
Leghorn
Pisa
Lucca
Cavara
Genoa 1 August
Reggio
Mantua
Padua
Venice 1 September
Bassano
Treviso
Vicenza
Verona
Bergamo
Breccia
Milan
Pavia
St. Simplon
Geneva
Neuchatel
Schaffausen [*sic*][205]
Oeningen
& perhaps afterwards into
Germany If I [deletion]
pass the winter on the Continent

[POSTSCRIPT ADDED AT HEAD OF LETTER] I enclose a letter for Webb, whose address I do not know, and beg you to send it to him.

XXXI Pencil date '19 March 1822'

My Dear Mr Buckland,

At the moment of my departure from this town I received through Mr Cuvier your kind letter of the 4th instant, and am sorry that I have not been able to peruse your most interesting paper on the Yorkshire Caverns,[206] it having arrived after my departure from Paris. You may rest assured that Cuvier and Laurillard shall only see it, so that there is no danger of its contents transpiring before its publication. As to your allusions to the bones found in fissures at Nice, Gibralter &c., I am not of your opinion as to the identity or rather analogy with the Caverns, because in only one instance has an extinct species of animal been found. This animal is the species of Lagomys which Mr Cuvier speaks of in his 4th vol., and although those fissures have been most carefully examined in several countries, none of [the] most common remains of the gravel beds have been found—such as Elephant, Rhinoceros, Hippopotamus & horse, not to speak of Bears, Hyaenas &c.

Before leaving Paris, I agreed with Mr Laurillard that he should take up my correspondence with you, so that you will hereafter you [*sic*] will address your letters to him. I fear he will not find time to write as long letters as I have, but he shall always feel most happy in serving you. We have agreed that he should write in French, and that you should write in English which Laurillard understands perfectly.

You speak of a Plaster cast of a bone which you suppose to be of Ichtyosaurus which you say you sent last summer. There must be some mistake here as I never received any such specimen—If you have still a cast of it, send it to Laurillard who will determine it as well as I could do.

We leave Lyons this Evg. for Turin. We remain as short a time as possible on the road so as to get to Rome on the first of April, where we shall remain until the first of June. I shall write to you from Rome, when I shall explain to you the future plans of my route. Write to me as often as you can. My address at Rome is aux Loins de M. Chiaveri[207] chez le Duc de Tortonie [?][207] à Rome.

Excuse my scrawl, my fellow traveller/is waiting for me in the/carriage, so I must close this/ wishing you every happiness Believe me

Your very sincere friend
Joseph Pentland

Lyons 19 March 1822
Hotel de l'Europe

To the
Revd. Wm Buckland F.R.S./Corpus College/Oxford

Postmark
Ap. 5 1822

XXXII This single letter, written to Cuvier by Pentland whilst on his Italian tour in 1822, is in the collections of the Institut de France (Carton 3244, pièce 58). The French text, as transcribed, is first presented without annotation. An English translation (courteously prepared by Dr Jocelyne C. Legault, in association with W.A.S.S.), with annotations, follows.

Privati

Florence 8 Decembre, 1822
Cafe Gazzeri
Piazza del Carmine

Monsieur,

Je vous ai annoncé il y a trois semaines que j'ai réussi de voir les os fossiles du Val d'Arno, que vous attendiez depuis long temps [*sic*], l'absence momentaires de M. Bardi le Directeur du Museum de Florence a retardé l'envoi plus long tems [*sic*] que je croyais—dans ma lettre je vous ai parlé de la cause qui a empêché que M. Nesti fasse l'envoi. Savoir que le Grand Duc n'a voulu rien donner sans savoir ce qu'il recevrait en échange—j'ai vu alors qu'il fallait offrir quelque

chose plus que les plâtres des ossemens qu'on a envoyé afin d'avoir quelques beaux morceaux qui manquent [word missing] ou entièrement à votre Muséum, ou qui sont si inutiles qu'on aurait besoin de les remplacer. J'ai pris la liberté par consequence de fournir une liste de ce que vous pouvez donner au Muséum ici. Je vous l'envoie et j'espère que vous trouverez que je ne suis pas allé trop loin, ou que j'ai promis des choses que vous ne pourriez pas donner—vous verrez que ce sont surtout des oiseaux et quelques quadrupeds [*sic*] du voyage de Lalande principalement, et que vous avez en si grand quantité.

Comme je me suis engagé de votre nom, je vous prie de faire expédier le plutôt possible les objets que vous voulez donner. Le Grand Duc qui prend un très grand interet dans son Muséum les attend avec impatience, et j'espère de pouvoir avoir quelques beaux morceaux d'ossemens, lorsque l'envoi sera arrivé. Comme il ne faut pas long tems [*sic*] pour faire cet envoi, serai-je vous prier de ne le pas laisser trainer, car je craindrais alors qu'on ne reussirait plus d'avoir rien d'ici, et comme il est probable que je reste à Florence envore deux mois, il serait convenable que les objets que j'ai promis arrivassent avant mon depart.

Vous verriez par le Catalogue ci-joint que je vous envoie un squelette presque complette [*sic*] d'Hippopotame. J'ai pris des pièces que je savis que vous aviez déjà, mais il est bon loin de rien refuser. Avec l'exception d'un omoplatte entier, vous aurez une aussi belle série des os de l'Hippopotame que le Musée de Florence. La tête et la machoire intérieur sont les plus complets des trois que j'ai examinés—Quant au Rhinoceros je ne puis pas dire autant. Quoique on a ici les extremités complets, je n'ai pas pu avoir autre chose que les os de l'extremité antérieur, mais je ferai mouler en plâtre l'extremité postérieur.

Je voudrais pouvoir vous dire tout ce qu'on a trouvé le plus remarquable depuis votre voyage en Italie, mais un tel détail outrepasserait les bornes d'une lettre. Au reste je vous le ferai connaître à mon retour—Il y a cependant quelques objets que peut—étre vous seriez bien aisé de connaitre avant de terminer votre bel ouvrage sur les fossiles. Si vous en voulez des dessins je les ferai faire, mais si vous aimeriex mieux des plâtres, je m'en chargerai moi-même.

Je ne parle pas du squelette presqu'entier du Mastodon trouvé recemment, comme M. Nesti publiera sous un mémoire la-dessus—ni des trois têtes d'Elephans [*sic*], dont on a trouvé deux lans le mois dernier—je passe aux Carnassiers, dont vous n'avez presque rien.

1. Hyène. M. Targeoni possède un tête entier, mais fort écrasé, et dont les dents manquent en grand parti—mais la forme générale de la tête est bien conservé, et je crois qu'il sera digne de paraître dans votre ouvrage. M. Targeoni a aussi deux portions de la machoire supérieure du même animal, renfermant les trois molaires postérieures—je me propose de faire mouler la meilleure.—Le Muséum de Florence ne possède qu'une machoire inférieure mutilé—mais Canali de Perugia m'a promis de m'envoyer un dessin d'une mieux conservé qu'il possède—Quoique j'ai cherché beaucoup je n'ai pas vu d'autre os de cet animal—excepté un morceau de vertèbre.

2. Ours. Il y a au Muséum un tête presqu'entier [*sic*] qu'on a apporté recemment de Figline. Un parti de l'occiput est cassé, mais toutes les molaires y sont, ainsi que la machoire inférieure. —La grandeur excède à peinc celle de l'ours noir d'Amérique. Il y a 6 molaires derrière les canines en haut. [Marginal comment: 'Comme dans l'U. longirostrus décrit par Siedemann.'] Les trois premières sont très petites, et rempissement tout l'espace entre les canine et les premiers grosses molaires. Je n'ai pas pu encore examiner la machoire infèrieur, étant recouverte de terre. Aussitot que j'aurai le tems [*sic*] je me mettrai de nettoyer le morceau et de le faire dessiner de suite.—Le Muséum possède un autre morceau de machoire renferment quelques dents. M. Targeoni en a aussi, mais peu important.—Le seul os d'ours que j'ai vu est la portion [deletion] supérieur du fémur, mais trouvé dans une position bien different de ceux du Val d'Arno, savoir ['dans' deleted] avec les Roches osseuses de Pise.—Ce morceau devait appartenir à un très grand individu—je ne puis pas dire avec certitude s'il appartient à un ours ou à un Lion, comme il est en partie envellopé de Stalactite—mais il n'est pas le moudre [?] dont qu'il ne peut pas provenir d'un Ruminant.

3. Chien. Il parait qu'il y en a de deux grandeurs qui correspond pour la taille du Loup ou du Renard.

4. J'ai trouvé dans le Museum de Targeoni deux dents Canines, qui ne peuvent pas se rapporter à aucun des animaux qu'on trouve dans le Val d'Arno.—Ces Canines sont très longues

et pointues, qu'on prendrait au premier coupe d'oeuill pour appartenir à des Carnassiers mais leur grand applatissement exclu ces derniers.—Le deux diamètres sont dans le rapport de 2/5 à 1.—Je serais tenter [*sic*] de croire que ces dents appartient ce même animal dont vous avez un portion de [deletion] bassin et que vous avez rapproché à des Tapirs. J'en ferai un plâtre.

5. Ruminans [*sic*]. Je vous ai parlé dans un [*sic*] autre lettre d'une belle tête de Boeuf et de bois d'un très grand Cerf du Val d'Arno, qui ne resemble à rien que j'ai vu; M. Targeoni m'a promis de les faire dessiner.

Je ne sais pas si vous avez examiné des os que Targeoni Tozzetti attribuent au Trichechus rosmarus—et qu'il avait trouvé dans les collines coquillières de Pise—je les crois du Lamaittin [?] mais je ne puis pas prononcer, car ils sont tous couvertes de terre. Il y a un coudre [?] et quelques autres os.—Cependant si vous voulez en avoir des dessins, je demanderai de les découvrir—M. Targeoni vient d'aquérir une machoire inférieur tout entier d'Eléphant de Val d'Arno, de la variété à menton pointu—c'est le morceau le plus complet que j'ai vu de cet animal.

Les Caisses vont partir pour Levouran après demain, pour etre embarqué pour Le Havre, s'il aura un bâtiment; autrement on les enverra à Marseilles, ou je vous prie de faire prevenir la Commissaire de Marine, afin de les fair plomber. Autrement je suis sur qu'on les casse.—Vous trouverez dans les caisses differents petits paquets signés de mon nom—ce sont des os qu'on m'a donné pour mes Collections, ou qu' j'ai acheté à Figline.

Ayez la bonté de me rappeller au souvenirs de Madame Cuvier, des demoiselles et de Laurillard et de me croire Votre bien Devoué

J. Pentland

Privat No. 2

Hippopotamus

No. 1. Tête presqu 'entier d'Hippopotamus, dont il ne manque due la partie inférieur des os de nez.
2. Machoire inférieur, appartenant à la même tête, dont un des Condyles seulement manque.
3. Omoplatte mutilé, mais qui offre une grande partie du contour.
4. Bassin qui manque les ailes iliaques et une portion du symphisis du Pubis.
5. Atlas.
6–7. Deux autres vertèbres cervicales.
8. Un des vertèbres anterieurs de dos.
9. Humerus entire.
10. Radius et Cubitus réunis très entire et du plus grand individu.
11–13. Os du Carpe.
14. [Deleted.]
15. Les 4 os du Metacarpes.
16. Fémur
qui correspondent à les seules portions du Fibule que
17. Tibia j'ai vu tout dans la collection de Targeoni. Je compte
d'en faire moulé un.
18. Rotula.
19–21. Os du Tarse. Je ne vous envoie l'Astragale et Calcaneum, comme je sais que vous en avez deja 2.
22. Les quatre os du metatarse.

Je n'ai pas pu avoir des phalanges, car le Muséum de Florence en possède très peu, et M. Nesti n'a pas encore commencé de les classer—je vous enverrai, je crois dans un autre envoi.

Eléphant

23. Les 3/4 inférieurs du fémur, montrant que l'espace entre les condyles reste toujours ouverte.
24–25. Deux molaires.
26. Défense très longue, qui a été brisé en 5 pièces, mais dont les fractures s'adaptent.

Rhinoceros

27. Portion de la machoire inférieur renferment 3 molaires entières et les alvéoles des qutres.
28. Molaire supérieur—mutilé.
29. Humerus entier.
30. Radius.
31. Cubitus.
31. [*sic*]. Les deux derniers os réunis.
33. Astragalus. Dans un autre envoi, on peut vous donner quelques os du Carpe et du Metacarpe. Pour le membre postérieus—il y en a rien.

Ruminantia

34. Tête presqu'entier d'un grand Ruminante.
35. Palais avec des dents supérieurs d'une espèce plus petit.
36. Machoire inférieur d'une espèce de la taille d'un Chevreuil.
37. Sept os du metacarpe et du métatarse, montrant qu'il y a au moins 4 espèces differents par les tailles.
38. Humerus d'un Cerf?
39–42. Quatre Astragales de diverses grandeurs.
43. Portion mutilé d'un corne de Cerf (3 morceaux).
44. Portion inférieur de Bois de Cerf plus petit.

Cheval

45. Partie de la machoire.
46–47. Canons antérieurs et postérieurs.
48. Astragale.
49. Morceau du terrain dans lequel se trouve les os fossiles du Val d'Arno, renferment des Unios et d'autres coquilles d'eau douce.

Florence le 7 Decr 1822. J. B. Pentland

Les ossemens compris dans le Catalogue ci-joint sont dans 5 caisses que j'ai addressé à M. Eyries de Havre s'il le trouvera un bâtiment à Levouran qui fait voile pour ce port—autrement on les enverra à Marseilles ou j'ai prévenu le Commissaire de Marine.

Vous trouverez dans ces caisses des objets qui m'appartiennent, chaque pièce a mon nom écrit dessus.—Ou est envelopper dans un papier sur lequel j'ai aussi ècrit. Il y a beaucoup de ces papiers dans la Caisse No. 2. Les autres sont distribués avec les os pour vous.—Je prie M. Cuvier de faire mettre de côté cequi est à moi jusqu'a mon retour à Paris.

J'espère pouvoir vous faire en autre envoie avant de quitter ce pays. Le Gd. Duc paraît fort parti d'être obligeant, et vous pouvez compter sur moi. Seulement je repète que tant cela dépendra sur ce que vous l'enverrez.—et l'expédition qu'on y mettra. J'ai fait la connaissance du Proprietaire des Mines de Charbon de Cadi Bona presso [?] de Savorne—qui m'a promis des os fossiles —je vous les enverrai aussitôt que je les aurai reçu.

J.P.

Privati

Florence 8 December, 1822
Cafe Gazzeri
Piazza de Carmine

Sir,

I announced to you three weeks ago that I had succeeded in seeing the fossil bones of the Val d'Arno, for which you had been waiting for so long; the temporary absence of M. Bardi,[208] the Director of the Museum of Florence, delayed the despatch longer than I believed—In my letter

I spoke to you of the reason which prevented M. Nesti[209] from sending them. You must know that the Grand Duke[210] did not want to give anything without knowing what he would receive in exchange—I saw then that one would have to offer something more than the plaster casts of the bones we have sent in order to have some fine pieces which are missing [word missing—perhaps 'partially'] or entirely from your museum, or which are so useless that they would need to be replaced. I have taken the liberty, in consequence, of providing a list of what you can give to the Museum here. I am sending it to you and I hope that you will find that I did not go too far, or that I have promised things that you could not give—you will see that they are mainly birds and some quadrupeds, mainly from the Lalande[211] voyage, and which you have in such great quantity.

As I am acting in your name, I ask you to send as quickly as possible the objects that you wish to give. The Grand Duke, who takes a very great interest in his Museum, waits for them impatiently, and I hope to be able to obtain some fine specimens of bones, when the shipment has arrived. As it should not take long to make this shipment, dare I ask you to not delay, because I would then fear that we would not succeed in getting anything else from here, and as it is probable that I will stay in Florence two more months, it would be appropriate that the objects which I have promised should arrive before my departure.

You will see from the catalogue here included that I am sending you a nearly complete hippopotamus skeleton. I accepted specimens which I knew you already have, but it is good to refuse nothing. With the exception of a complete shoulder-blade, you will also have as good a series of hippopotamus bones as the Florence Museum. The skull and the lower jaw are the most complete of the three which I examined. As for the rhinoceros, I cannot say as much. Although they have here the complete extremities, I could not obtain more than the bones of the front extremity, but I will have moulded in plaster the posterior extremity.

I wish I were able to tell you all that we have found the most remarkable since your journey in Italy, but such detail would exceed the limits of a letter. For the rest, I will let you know on my return.—There are however some objects which perhaps you would like to hear about before finishing your fine work on the fossils. If you wish for drawings, I will have them made, but if you would prefer plaster casts, I will see to it myself.

I do not speak of the nearly complete skeleton of a Mastodon found recently, since M. Nesti will soon publish a memoir on it[212]—nor of the three elephant skulls, two of which were found last month—I pass on to the carnivores, of which you have hardly any.

1. Hyena. M. Targeoni[213] possesses a complete, but very crushed, skull, whose teeth are largely missing—but the general form of the skull is well preserved, and I believe that it will be worthy of appearing in your work. M. Targeoni also has two portions of the upper jaw of the same animal, containing the three posterior molars—I propose to make moulds of the best.—The Museum of Florence only has a mutilated lower jaw—but Canali[214] of Perugia has promised to send me a drawing of a better preserved one which he has.—Although I searched a lot I did not see any other bones of this animal—except for a fragment of vertebra.

2. Bear. There is in the Museum an almost complete skull which was recently brought from Figline.[215] A part of the occiput is broken, but all the molars are there, as well as the lower jaw.—The size scarcely exceeds that of the American black bear. There are six molars behind the canines on the top. [*Marginal insertion*: 'As in the U[rsus] longirostrus described by Siedemann[216]]. The first three are very small and fill all the space between the canines and the first large molars. I have not yet been able to examine the lower jaw, [it] being covered by earth. As soon as I have the time, I will set myself to cleaning this piece and have it drawn immediately after.[217]—The Museum possesses another piece of a jaw containing several teeth. M. Targeoni also has [one], but less important.—The only bear bone that I saw is the upper portion of the femur, but found in a position very different from those of Val d'Arno, to wit with the osseous rocks of Pisa.—This piece must have belonged to a very large individual—I cannot say with certainty if it belonged to a bear or to a lion, as it is in part enveloped in stalactite,—but it is not the grinding tooth, therefore it cannot come from a ruminant.

3. Dog. It seems that there are two sizes, which correspond in dimensions to a wolf and a fox.

4. I found in Targeoni's Museum two canine teeth, which cannot be related to any of the animals which one finds in the Val d'Arno.—These canines are very long and pointed; one takes them at first sight as belonging to carnivores, but their great flattening excludes the latter. The two diameters are in the ratio of 2/5 to 1.—I would be tempted to believe that these teeth belong to the same animal of which you have a portion of pelvis and which you have related to the Tapirs. I will make a plaster cast.

5. Ruminants. I have spoken in another letter of a fine bull's skull and of antlers of a very large stag from the Val d'Arno, which resembles nothing I have seen. M. Targeoni has promised to make me drawings of them.

I do not know if you have examined the bones that Targeoni Tozzetti attributes to Trichechus rosmarus[218]—and which he found in the shelly hills of Pisa.—I believe them to be of Lamaittin [?][219] but I cannot pronounce with confidence, because they are all covered with earth. There is an elbow [?] and some other bones.—However if you wish for drawings of them, I will ask to have them uncovered.—M. Targeoni has just acquired a quite complete lower jaw of [an] elephant from Val d'Arno, of the variety with pointed chin—this is the most complete example I have seen of this animal.

The boxes will leave for Levouran[220] the day after tomorrow, to be embarked for Le Havre, if there is a vessel; otherwise we will send them to Marseilles, where I pray you to advise the Commissaire de Marine, in order to have them sealed. Otherwise I am certain that they will be broken.—You will find in the cases various small packages signed with my name—these are the bones which were given to me for my collection, or which I bought from Figline.

Please be good enough to recall me to the recollections of Madame Cuvier, the girls and Laurillard and to believe me your devoted.

J. Pentland

Privat No. 2

Hippopotamus

No. 1. Almost complete skull, of which only the lower part of the nasal bones are missing.
2. Lower jaw, belonging to the same head, of which only one of the condyles is missing.
3. Mutilated shoulder-blade, but which exhibits a large part of the outline.
4. Pelvis which lacks the iliac wings and a portion of the pubic symphysis.
5. Atlas.
6–7. Two other cervical vertebrae.
8. One of the anterior back vertebrae.
9. Complete humerus.
10. Radius and cubitus joined together very completely and from a very large individual.
11–13. Carpal bones.
14. [Deleted.]
15. The 4 bones of the metacarpus.
16. Femur.
17. Tibia. which correspond to the only portions of the fibula which I have seen in the whole collection of Targeoni. I plan to make a mould of one.
18. Rotula.
19–21. Bones of the tarsus. I do not send the astragalus and the calcaneum, because I know you already have 2.
22. The four bones of the metatarsus.

I have not been able to get the phalanges, because the Museum of Florence has very few, and M. Nesti has not yet started to classify them—I will send them, I hope in another shipment.

Elephant

23. The lower 3/4 of the femur, showing that the space between the condyles always remains open.

24–25. Two molars.
26. Very long tusk, which has been broken in 5 pieces, but whose fractures fit.

Rhinoceros

27. Portion of the lower jaw containing 3 complete molars and the alveoli of the others.
28. Upper molar, damaged.
29. Complete humerus.
30. Radius.
31. Cubitus.
31. [*sic*] The two latter bones, united.
33. Astralagalus. In another shipment, we can give you some bones of the carpus and of the metacarpus. For the posterior member—there is nothing.

Ruminantia

34. Almost complete skull of a large ruminant.
35. Palate, with the upper teeth, of a smaller species.
36. Lower jaw of a species of the size of a deer.
37. Seven metacarpal and metatarsal bones, indicating that there are at least 4 different species by their sizes.
38. Humerus of a stag?
39–42. Four astragali of diverse sizes.
43. Damaged portion of the horn of a stag (3 fragments).
44. Lower portion of the antler of a smaller stag.

Horse

45. Section of the jaw.
46–47. Anterior and posterior cannons.
48. Astragalus.
49. Portion of earth in which are found the fossil bones of the Val d'Arno, containing Unios and other freshwater shells.

Florence 7 December, 1822 J. B. Pentland

The bones included in the Catalogue sent herewith are in the 5 boxes which I have addressed to M. Eyries of Le Havre if a vessel is found at Levouran[220] which sails for this port—otherwise they will be sent to Marseilles, where I have advised the Commissaire de Marine.

You will find in these cases objects which belong to me; each piece has my name written on it—or is wrapped in a paper on which I also wrote. There are many of these papers in Box no. 2. The others are distributed with the bones for you.—I pray M. Cuvier to put aside what is mine until my return to Paris.

I hope to be able to send you another shipment before leaving this country. The Grand Duke appears quite inclined to be obliging, and you can count on me. Only I repeat that all this depends on what you will send to him—and the speed with which they are sent. I have made the acquaintance of the Proprietor of the Coal Mines of Cadi Bona presso [?] in Savorne—who has promised fossil bones—I will send them to you as soon as they are received.

J.P.

XXXIII. The last letter of this correspondence is from the collection of the late Dr Victor A. & Mrs Joan M. Eyles, Great Rissington, Gloucestershire. That it is again addressed to Buckland is clear from its contents, though the addressee is not named:

Paris 28 feby 1824
No 98 rue du faubourg du Roule

Dear Sir,

Our friend Cuvier has this moment requested me to write to you on the subject of the paper which you proposed publishing on the Stonesfield reptile the Megalosaurus. He is now at that part of his work where he intends speaking of your reptile, and wishes to know if your paper has been yet published—and in what form? And in what work?[221] He is also desirous of knowing whether any thing new has appeared on the genera Ichtyo & Plesio—sauri since he is on the point of publishing his remarks thereon. M. Cuvier sent you the 1st part of his Ve Vol. nearly 3 months ago by the Abbé de Rouffigny,[222] he is anxious to be informed if you have received it, he sent at the same [time] copies to Sir E. Home & Mr Clift, who have not acknowledged the receipt of it.

M. Cuvier will send you in a few days by Mr Temmink [*sic*][202] some casts of bones which were found at Honfleur & which he supposes to belong to the Megalosaurus; he wishes you to compare them with those in your collection and to give him your opinion on the subject, but he will write to you himself by Mr Temmink [*sic*]—and would have done so now had he not been very busily occupied by the Government and the Elections. He is about to commence the History of Fossil fishes. Having arranged and described all the living species of the collection amounting to more than 2,500 species, he will commence the publication as soon as he shall [have] finished his fossil Reptiles which will be in April next.

I expect to be in England in all March; my stay there will be short. From thence I shall return to Italy and pass next winter in Sicily.

We have nothing new in Geology here; all expect anxiously the new edition of your Reliquiae[223] —I have a packet of pamphlets to send you, but am waiting for an opportunity, having no longer the permission to send by the Foreign Office. If Mr Temmink [*sic*] will take charge of them I shall desire him to leave them, with the plaster casts from Cuvier, at the Geological Society.

Yours faithfully,
J. B. Pentland

[On back] I have some notion of presenting a very fine collection of fossil bones to one of our Museums. Would they be acceptable to the Geol: Society? or would it be better to offer them to the Brit: Museum?[224]

I do not say any thing of the Walruss you intend sending Cuvier, not having received an answer from you on the subject.

The last four letters which we include all date from Pentland's later period of work in Cuvier's laboratory. The first two provide yet another evidence of Pentland's frequent and (it seems) always very willing services as cicerone to visitors to the French capital. His visitor on this occasion was Alexander Turnbull Christie, a Scot who had served as assistant surgeon with the East India Company and had returned to Europe in 1828. For the two years that followed, he was engaged in studying geology, meteorology and other branches of science in Edinburgh and on the Continent. In 1830 he was appointed geological surveyor on the Madras establishment; his letter evidently refers to his endeavours to secure this post. Christie did not return to India until 1831 and died there in 1832; during his short scientific career he contributed a number of papers to the *Edinburgh New Philosophical Journal.*

XXXIV This letter dates from 1830; it is unsigned, but undoubtedly written by Christie. The penultimate paragraph makes it clear that Pentland was again seeking Governmental employment, perhaps in a consular capacity; but it appears that, this time, he was unfortunate.

[1830]

My dear Pentland,

I have herewith the pleasure of sending you your books and papers. I am happy to have this early opportunity of again assuring you that I shall always remember how much I am indebted to you for your many acts of kindness, and that if I can do anything for you here I hope you will command me.

I called on Sir John Franklin, but he was not at home. I therefore wrote a note to him requesting him to let me know whether he had sent you the books.—I have not yet received his answer.—I shall probably not see him before next Wednesday on which day I am to dine with him.—I will ask Mr Murchison today about the volumes of the Geol. Trans. I delivered your letters to him yesterday, and had ['received' deleted] a very kind reception from him.—I am to meet him today at the rooms of the Geological Society.—I have not yet had time to call on Mrs Lee,[225] but shall probably do so tomorrow.

I am sorry to find that there is no meeting of the Geological Society this week.—I therefore intend to remain in town till the end of next week, that I may have an opportunity of seeing Buckland, Sedgwick and the other members before going to Scotland.—I have seen none of my Indian friends yet.—Mr Elphinstone is in town, but was not at home when I called on him.—I understand he says he will do all in his power to serve me, but is very doubtful whether the Court will make the appointment at present, they are persisting so resolutely in their saving [?] system. However I am [twice repeated] not without hopes of success.

My boxes that were dispatched by the roulage acceleré, had not arrived at Calais when I was there! I left directions with Mons. Bignolle to forward them to his agents in London, who will reship them for Leith., As M. B. is in the daily habit of executing commissions of this sort I have no doubt they will arrive quite safe.—

XXXV. Pentland's response suggests that he was at this time engaged in final work on his map of Lake Titicaca (see p. 251).

[1830]
Dear Christie,

I enclose a letter wh. [which] I only yesterday received from home in attention of the porter at No. 7.—I also received my last courier the packet of papers you were kind enough to send me, and am now over head & ears in calculations for my map.

I sincerely rejoice that you have found my friends so obliging and I trust you will be no less so with Dr Buckland when you shall have known him. I expect to hear further from you on the subject of your prospects on [two illegible words].

I have received the two volumes of Brocchi,[226] which I shall send you (addressed to the Oriental Club) in a few days, as soon as Cuvier's 5th vol. is out wh. [which] it will early in next week.

I shall feel much obliged by your still attending to my [word illegible] about yr. books, as I wish to have them to send on to my friends in Italy—let me know quickly your outlay on my acct. [account] that I may send you the money—short accts. [accounts], long friends you know.

I am subpoenad to appear in London as a witness in a law suit on the 30th so I must go—but only for *a day*—I am sorry you will not be then in town. Do not let this prevent you sending me the Books however—Should you be in town, you will find me probably at Halchetts [?] Hotel Piccadilly the 29th or 30th.

We have nothing new here, except a Geol. Socy, wh. [which] is in embryo and promises *fever*[227] —I do not intend however to belong to it.

Yours very sincerely,
J. B. Pentland

Your Auvergne Box arrived and was sent on to Calais 4 days after you left Paris.
Paris 19th March.

The final two letters, both addressed to Pentland, are contained in the archives of the University of St Andrews, Scotland (J. D. Forbes papers 1831/26 and 1833/4). Both suggest that Pentland had become an active and well-known figure in the Parisian scientific world of his time. In each instance, the French text is given first and an English translation (again courteously prepared by Dr Jocelyne A. Legault, in consultation with W. A. S. S.) follows, with annotations.

XXXVI This letter, which predates Cuvier's death, is a response by the Société Géographique de France to an offer by Pentland to convey to England the gold medal which that Society had awarded to the distinguished Arctic explorer Sir John Franklin (1786–1847), who was then away in the Mediterranean in command of H.M. frigate *Rainbow*. (It is possible that Pentland may have been related to Sir John or to Lady Franklin!)

Bibliothèque du Roi
Paris le 2 Aout 1831

Monsieur,

Sur la réponse que Lady Franklin a faite à la proposition de se charger de la Médaille d'or de la Société géographique de France pour son mari, je viens de déposer cette médaille au Ministère de la Marine. Cette Dame a dit qu'elle pensait que le Capitaine serait pous flatté de la recevoir par l'intermediaire du Commandant de la Croisière française. Je n'en suis pas moins très sensible, à l'offre obligeante, Monsieur, et je vous prie d'en agréer l'assurance avec celle de ma considération distinguée.

Jomard.
Membre de l'Institut

To Monsieur
Monsieur Pentland,
Paris

Bibliothèque du Roi
Paris, 2 August 1831

Sir,

Regarding the response which Lady Franklin[228] made to the proposition that she accept the gold medal of the Geographical Society of France for her husband, I have just deposited this medal with the Naval Ministry. This Lady said that she thought that the Captain would be more flattered to receive it through the intermediary of the Commander of the French fleet. I am nonetheless very sensible of your kind offer, Sir, and I pray you to accept the assurance of this as well as my distinguished consideration.

Jomard.[229]
Member of the Institut.

To Monsieur Pentland, Paris.

XXXVII This last letter, which postdates Cuvier's death, may well have been written whilst Pentland was still engaged in cataloguing the collection at the Jardin du Roi. Its author was Augustin Pyramus de Candolle (1779–1841), the great Swiss plant taxonomist.

[Pencilled superscription 'De Candolle
of Geneva']

Mon cher Monsieur,

Ce billet vous sera remis par Mr Perrottet voyageur botaniste dont je vous ai parlé lorsque j'ai eu l'avantage de vous voir à Paris; il désire sérieusement aller dans la république de Bolivia et je lui ai fait espérer que vous lui donneriez les directions et renseignements necessaires pour rendre son voyage utile à la Botanique et à la culture. Je vous aurai bien de l'obligation si vous voulez lui consacrer quelques momen[t]s dans ce but et avec l'activité et la bonne volonté qu'i porte à ce genre d'entreprises je ne doute point qu'il ne fasse fructifier vos bonnes instructions.

Agrée je vous prie l'expression de la consideration distingué avec laquelle j'ai l'honneur d'être

votre très devoué
A. P. de Candolle

23 août 1833
à Monsieur Pentland
rue de l'Université n.22
a Paris

My dear Sir,

This note will be given to you by M. Perrottet,[230] botanical traveller, of whom I spoke to you when I had the opportunity of seeing you in Paris; he seriously desires to travel in the Republic of Bolivia and I allowed him to hope that you would give him the directions and information necessary to make his voyage useful to Botany and culture. I would be very obliged if you wished to devote a few moments to this purpose and with the activity and good faith which he brings to this type of enterprise, I do not doubt that he will bring your good instructions to fruition.

I pray you to accept the expression of the distinguished consideration with which I have the honour of being

your very devoted
A. P. de Candolle

23 August 1833
to Monsieur Pentland
Rue de l'Université n.22
à Paris

Acknowledgements

Particular thanks are expressed to the University of Nottingham, and especially to its Library Committee, for enabling this work to be written by purchasing the long series of letters which form the bulk of those here published and for allowing one of us (W.A.S.S.) to transcribe them. The encouragement and support of Lord Energlyn of Caerphilly, which was crucial in this matter, also merits especial mention, as does the help given by Mrs M. A. Welch, Keeper of the Manuscripts at the University of Nottingham, for furnishing photographs and Xerox copies of these letters.

The authors would also like to thank Mrs Joan M. Eyles, for furnishing copies of the letters in the Eyles' collection; Mme. Hautecoeur, Conservateur-en-Chef, Bibliothèque de l'Institut de France, Paris, for furnishing copies of the two letters in the archives of the Institut; the Trustees of the National Library of Scotland, for permission to include the letters exchanged by Pentland and Christie, and Mr D. MacArthur, Librarian and the Library of the University of St Andrews, for access to, and permission to publish, the letters to Pentland from Jomard and de Candolle.

During the editing and transcription of these letters, the authors received help from a number of persons. Dr Jocelyne A. Legault, then of the Dept of Geological Sciences, University of Saskatchewan, Saskatoon and now of the University of Waterloo, Ontario, kindly helped in the transcription of the French passages and prepared a translation of the letter to Cuvier; Professor L. B. Halstead (Dept. of Geology, University of Reading) provided helpful notes on Pentland's work on fossil marine reptiles; Dr E. H. Milligan, Librarian of the Religious Society of Friends, London, tried in vain to trace the Barclay connexion of Pentland on our behalf; Mr J. R. Friday, then of the Science Policy Research Unit, University of Sussex, searched the Davy letters (equally vainly) for Pentland references; and Dr C. P. Hughes (Sedgwick Museum, Cambridge) gave help concerning the early history of trilobite study. Mr Anthony P. Harvey, Librarian (Palaeontology) of the British Museum (Natural History) and Mr Robert Fleetwood, then of the University of Nottingham Library and now of the University of Strathclyde, both helped extensively in tracing references. We are further indebted to Mr David A. E. Spalding (Provincial Museum of Alberta, Edmonton, Canada) for reading and critically commenting on the manuscript. The first draft of the manuscript was prepared by Miss Francis Hoare (Nottingham) and the complex task of typing the final manuscript was valiantly tackled by Ms. Nancy Allan (Saskatoon). To all these persons, we would like to tender our sincere thanks.

Notes

1 Jean-Léopold-Nicolas-Frédéric, Baron Cuvier (1769–1832) early adopted the name 'Georges' by which he is generally known, as a consequence of the death of his elder brother, Georges-Charles-Henri (1765–1769), in the year of his birth.
2 Rather surprisingly, the principal archive of Buckland's correspondence and papers—the Devon County Record Office, Exeter (Oke Papers)—contains no letters to or from Pentland.
3 Though he speaks of his 'parents' in one letter (p. 285), it is to be presumed that he was referring to his foster-parents, whom we have not succeeded in identifying.
4 Thomas Webster (1773–1844), author of several important works on the stratigraphy of southeast England.
5 'I am at the Garden from 6 AM to 8 PM every day, busy either dissecting or picking out Montmartre bones, at which Cuvier is now working.' (p. 278).
6 Father John MacEnery (1796?–1841), principally remembered for his investigations of the caverns of Devonshire.
7 Kents Cavern, near Torquay. MacEnery was incorrect; the tooth found in this cavern was of a sabretooth (*Machairodus latidens* Owen).
8 Cuvier's earlier name has taxonomic priority, however: this species is still known as the Etruscan Bear (*Ursus etruscus* Cuvier).
9 William Henry Fitton (1780–1861), another Irishman who migrated to England, was a distinguished stratigrapher and earliest British geological historian, was at that time President of the Geological Society of London.
10 Sir Woodbine Parish (1796–1882), afterwards Consul-General at Buenos Aires, where he collected skeletal remains of the great edentate *Megatherium*, on which Buckland later made extensive studies.
11 See note 9.
12 See note 132.
13 Sir Roderick Impey Murchison (1792–1871), second Director of the Geological Survey of Great Britain, a former soldier who became one of Britain's greatest geologists.
14 James Parkinson (1755–1824), also a surgeon, author of *Organic Remains of a Former World* (3 vols., 1804–1811).
15 Sir Thomas Livingstone Mitchell (1792–1855), destined later to become one of the most distinguished Australian explorers.
16 Robert Jameson (1774–1825), Professor of Natural History in the University of Edinburgh, renowned as Britain's leading exponent of Wernerian theories of the origin of rocks and minerals.
17 Charles Lyell (1797–1875), one of the greatest of all stratigraphers and author of the *Principles of Geology* (1830–33, 3 v.) which established the general applicability of uniformitarian concepts.
18 Christian Erich Hermann von Meyer (1801–1869), of Frankfurt-am-Main, who was effectively the founder of vertebrate palaeontology in Germany.
19 Pentland's geographical work in Bolivia is currently under study by Sr. Jack Aiken-Soux, Av. Villazon 240, Casilla 58, Potósi, Bolivia,
20 Sir Archibald Geikie (1835–1924), distinguished geologist and scientific historian, fourth Director General of the Geological Survey of Great Britain and President of the Royal Society 1908–1913.
21 Hugh Falconer (1808–1865) is especially remembered for his pioneer studies of the fossil vertebrate fauna of India.
22 Robert Edmond Grant, F.R.S., (1793–1874) lectured in palaeontology at University College London and was a spirited participant in a number of palaeontological controversies.
23 William Willoughby, 3rd Earl of Enniskillen (1807–1886), a collector of fossils, especially fossil fishes.

24 Sir Philip de Malpas Grey Egerton (1806–1881), a close friend of the Earl of Enniskillen and also a fossil collector, undertook pioneer researches on vertebrate remains and fossil footprints in the west Midlands of England.

25 George Bellas Greenough (1778–1855), one of the founders of the Geological Society of London, who produced one of the earliest geological maps of England and Wales.

26 George William Featherstonhaugh, F.R.S. (1780–1866) undertook pioneer geological researches during travels in the United States and subsequently entered the British diplomatic service.

27 Sir Andrew Crombie Ramsay (1814–1891), who succeeded Murchison as Director of the Geological Survey.

28 Then the residence of Thomas Atherton Powys, third Baron Lilford (1801–1861).

29 This manorhouse, rebuilt by George Vivian in 1819, is now a museum of American domestic life.

30 He collaborated with James Fergusson (1808–1886) in the writing of *Sketches of the Antiquities of Cusco* (18??) and provided data on South America for Mrs Somerville's *Physical Geography* (London (Murray), 1848. 5th ed. 1862).

31 The fact that Pentland *was* permitted to work in Cuvier's private laboratory and library and to consult his portfolios (p. 273) is a strong indication of the regard in which Cuvier held him.

32 Pentland notes (p. 291) that Cuvier had put him in charge of casting.

33 Sir Stamford Raffles (1781–1826), great British colonizer and founder of Singapore; an enthusiastic naturalist, responsible for the discovery of many animal and plant species.

34 Herbert Wendt, in his book *Out of Noah's Ark* (London: Weidenfeld & Nicholson, 1959. XII, 464 pp.) suggests that this was a consequence of Cuvier's having anticipated Raffles by publishing the first description of the Malayan tapir on the basis of a letter from Diard; but Wendt's account is certainly not to be relied upon, for he describes Diard 'as an experienced animal collector with a knowledge of the Tropics' and suggests that Duvaucel had already smuggled out a major shipment of specimens for Cuvier in Paris, which (as Pentland's letters evidence) was certainly not the case.

35 The principal source for these details is R. Amat (Director), *Dictionnaire de biographie française* (Paris: Letourzey et Ané, 1970, 12 volumes to date). The entry for Duvaucel (vol. 12, p. 1010) notes 'Fort dépité, Duvaucel revint seul à Calcutta', but the Diard entry (vol. 11, pp. 252–3) does not make clear his movements between February 1819 and 1821, so that Wendt (1959 see note 34) may be correct in saying that Diard was jailed for two years in Java, for suspected espionage, by the Dutch authorities. However, Wendt's statement that this was a further consequence of Raffles' anger over the tapir incident can surely be discounted!

36 The suggestion in one of Pentland's letters (p. 286) that the *original* collection was being sent to Paris is surely misleading; it is evident, however, that Duvaucel had contrived to retain *a part* of his first Sumatran collection and had supplemented it by subsequent collecting.

37 Sir Henry Thomas Delabeche [also frequently written De la Beche] (1796–1855), distinguished geologist and first Director of the Geological Survey of Great Britain.

38 Presumably of Lower Liassic ichthyosaurs, since the letter subsequently deals with such remains from Dorset.

39 Pentland's observations on the osteology of ichthyosaurs and its interpretation are consistently highly perceptive; they are discussed in Delair and Sarjeant (1976).

40 The Common Porpoise, *Phocaena phocaena* (Linnaeus).

41 Charles Laurillard (1783–1853) joined Cuvier as draughtsman and secretary in 1804 and worked with him for 30 years, becoming his devoted friend and accompanying him on two visits to Italy and on visits to Germany and England. 'For the history of science, the name of Laurillard is inseparable from that of Cuvier' (G.-L. Duvernoy, transl.). Mentioned in many of Pentland's letters.

42 Colonel J. (T.) Birch (c. 1768–1829) (see H. S. Torrens: Geological Curators Group Newsletter, vol. 2, no. 7, 1979, pp. 405–412), the earliest important collector of the Liassic saurians of Lyme Regis, Dorset. His collection was sold at auction in the Egyptian Hall, Piccadilly, on 15 May 1820. (The British Museum also purchased some of his fossils).

43 William Elford Leach (1780–1836) became Assistant Keeper of the Natural History Department of the British Museum in 1816 and retired as a result of ill-health, brought on by overwork, in 1822. His illness, and the question of appointment of a successor, is treated at length in later letters.

44 William Clift (1775–1849), a Cornishman who had worked as assistant to the distinguished surgeon and collector John Hunter (1728–1793), was at this time Curator of the Museum of the Royal College of Surgeons of London.

45 The chamaeleon (*Chamaeleon*).

46 Now *Gavialis gangeticus.*

47 Sir Everard Home, F.R.S. (1756–1832), brother-in-law of John Hunter and himself a surgeon of catholic interests, was the author of a number of papers on fossil vertebrates.

48 'On the mode of formation of the canal for containing the spinal marrow, and on the form of the fins (if they deserve that name) or the Proteosaurus.' *Phil. Trans Roy. Soc., Lond.* **110**, 1820: 159–164, pl.xvi.

49 Subsequently named *Plesiosaurus*; see H. T. De la Beche and W. D. Conybeare, 'Notice of the Discovery of a new fossil Animal, forming a link between the Ichthyosaurus and the Crocodile, together with general remarks on the osteology of the Ichthyosaurus', *Trans. geol. Soc. Lond.* **5**, 1821: 559–594. The influence of Pentland on the early studies of this second reptile is treated in Delair and Sarjeant (1976).

50 William Daniel Conybeare (1787–1857).

51 May be William Daniel Conybeare or Georges Cuvier; the French form suggests the latter.

52 See note 47.

53 The Royal Society, London, which was founded in 1660.

54 At about this time, rhinoceros fossils were found at Lawford, near Rugby, Warwickshire; Buckland was concerned in this discovery and may well have undertaken to send one of the skulls to Cuvier. (See W. Buckland, 1823, pp. 26, 27).

55 Undoubtedly the *Megalosaurus*. Buckland had found these bones before Cuvier's visit to Oxford in 1818, since Cuvier had seen and drawn them during his visit (*Ossemens fossiles*, vol.V, 1824, p.2); this ranks as the earliest definite discovery of dinosaur bones by any scientist, amply predating the finding of the tooth of *Iguanodon* by Mantell's wife in March, 1822, which has often been considered to have occurred at the same time as, or earlier than, the discovery of *Megelosaurus*. For discussion see J. B. Delair and W. A. S. Sarjeant (1975).

56 Alexandre Brongniart (1770–1847), Cuvier's colleague and close friend, was Professor of Mineralogy at the Musée d'Histoire Naturelle. His own work was primarily on invertebrates and in particular on trilobites, but he collaborated with Cuvier on joint researches on the geology of the Seine basin which were to prove of fundamental importance in Cretaceous and Tertiary stratigraphy.

57 Charles Stokes (1783–1853), member of the Stock Exchange and collector of almost everything, fossils included; an early member of the Geological Society of London.

58 Presumably Nicolas Desmarest (1725–1815), a major French geologist especially famous for his work on the history of the Auvergne; but, if so, his contribution to the work was posthumous.

59 Leopold von Buch (1774–1853), the great German geologist.

60 Not identified.

61 Thomas Richard Underwood (c. 1765–1836), English landscape painter and scientific dilettante.

62 Charles Giles Bridle Daubeny (1795–1867), chemist and geologist, Professor of Botany at Oxford from 1834; remembered especially for his work on volcanoes.

63 The *Memoirs of the Wernerian Natural History Society*, published in Edinburgh, consistently affirmed Jameson's belief in the marine origin of basalts; this theory was at this time tottering towards oblivion and Daubeny's work was helping to undermine it.

64 Baron Ernst von Schlotheim (1764–1832), the distinguished German palaeontologist.

65 *Petrefaktenkunde* (1820).

66 See *Isis*, Jena, Vol. 6, pt. 6, 1820, unnumbered preliminary page.

67 A volcano in Peru. Cuvier described the molar of a mammoth from this mountain, found and given to him by Humboldt.

68 The Mammoth (*Mammuthus primigenius* Blumenbach), whose frozen remains were known to occur in the banks of the Lena River, Siberia.

69 The straight-tusked mastodont.

70 The Cave Lion (*Felis leo spelaea*).

71 The Cave Hyena (*Crocuta crocuta spelaea*).

72 Francois Sulpice Beudant (1787–1850), French mineralogist and palaeontologist.

73 Pentland's awareness that intergradations exist between mica-schist and granite or gneiss is especially noteworthy at this early date. Although James Hutton (1726–1797) had already sketched out the concept of metamorphism, it was as yet neither comprehended nor widely accepted.

74 Presumably George Francis Lyon (1795–1832), naval captain and traveller, whose *Narrative of Travels in North Africa in the Years 1818, 1819 and 1820, accompanied by Geographical Notes of the Soudan and the Course of the Niger* was published about this time.

75 Not identified.

76 The 'Elegy Intended for Professor Buckland', written by Richard Whately on 1 December, 1820: quoted in full in Mrs Gordon's *Life and Correspondence of William Buckland* (London (Murray) 1894, pp.41–2) and since featured in many anthologies of humorous verse.

77 Samuel Stevens, English collector of British lepidoptera and coleoptera : brother of natural history auctioneer J. C. Stevens of King Street, Covent Garden, London and later serving as agent for Alfred Russel Wallace and other naturalists in their sales of natural history specimens, especially birds.

78 Friedrich Wilhelm Heinrich Alexander von Humboldt (1769–1859), the great German polymath and traveller, who resided frequently in Paris during this period.

79 *Personal Narrative of travels to the Equinoxial Regions of the New Continent during the years 1799–1804* (English translation by Helen M. Williams, 5 vols., published in 1824).

80 Probably his *Cours élémentaire d'histoire naturelle.* 1st edition. (Paris, 1841).

81 Perhaps Aylmer Bourke Lambert (1761–1842) of St Mary Hall, a founder member of the Linnean Society of London.

82 Presumably "rhinoceros' head and ichthyosaurus' head" is meant.

83 Hans Conrad Escher von der Linth (1767–1823), distinguished Swiss geologist and father of the even more renowned geologist Arnold Escher von der Linth (1807–1872).

84 André-Jean-Marie Brochant de Villiers (1772–1840), Professor of Mineralogy at the École des Mines, Paris.

85 John Henry Heuland (1778–1856), fashionable London dealer in mineral specimens and himself a notable mineralogist, was Foreign Secretary of the Geological Society of London from 1818 to 1828.

86 Sir Joseph Banks (1743–1820), President of the Royal Society for 40 years, and patron of science.

87 'Eloge historique de Sir Banks, lu le 2 Avril 1821', in *Recueil des Eloges historiques de l'Institut de France par G. Cuvier*, vol.2, pp.199–230.

88 William Phillips (1773–1828), founder member of the Geological Society of London and author of *A selection of Facts from the best Authorities, so arranged as to form an Outline of the Geology of England and Wales* (1818), to which Pentland is here referring.

89 Cordier was elected to membership of the Geological Society during 1821.

90 William Sharp MacLeay (1792–1865), a co-founder of the 'Zoological Club' which flourished briefly in England around this time; eldest son of Alexander MacLeay, who was Secretary of the Linnean Society of London and founder of the Linnean Society of New South Wales.

91 G. A. Mantell's *The Fossils of the South Downs* was not published until 1822; the prospectus must have been issued, therefore, amply in advance of publication.

92 René-Just Haüy (1743–1822), distinguished French mineralogist and crystallographer, under whom Pentland had studied (see p. 272).

93 Perhaps the engineer Louis-Antoine Beaunier (1779–1835), who was undertaking metallurgical researches in the years 1819–1823 and may well have travelled to London.

94 John Kidd (1775–1851), Professor of Chemistry at Oxford from 1805 to 1810 and thereafter continuing to work privately on chemistry till his death.

95 Sir William Parry, F.R.S. (1790–1855), Arctic explorer who had recently been in command of the *Hecla* in an attempt on the Northwest Passage, succeeding in penetrating as far as Melville Island, and who left in May 1821 on a second unsuccessful attempt at the Passage. Later (1827) Parry led an expedition from Spitzbergen towards the North Pole which attained to 82° 45′ north; this remained 'farthest north' for over 50 years thereafter. A most appropriate person from whom to request the skull of a musk-ox!

96 'On the Structure of the Alps, and their relation to the Secondary and Transition Rocks of England'. *Ann. Phil.* (N.S.) **1,** 1821: 450–468.

97 Mary Morland, eldest daughter of Benjamin Morland of Sheepstead House, near Abingdon, Berkshire. It is said that Buckland met her when travelling by coach in Dorset and entered conversation with her because they were both reading the same volume by Cuvier: Buckland then exclaimed 'You must be Miss Morland, to whom I am about to deliver a letter of introduction!' (see Mrs Gordon, *The life and correspondence of William Buckland, D. D., F.R.S.* (London: Murray 1894, p.91)). They were married on 31 December 1825, their strong common interest in fossils no doubt facilitating both courtship and subsequent life together!

98 Louis-Joseph Gay-Lussac (1778–1850), distinguished chemist, remembered especially for his studies of the expansion of gases.

99 Not identified.

100 Louis-Jacques Thénard (1777–1857), a colleague of Gay-Lussac in the chemical laboratory of the Ecole Polytechnique, Paris; discoverer of hydrogen and associated with Gay-Lussac in the discovery of boron. Made a baron in 1824, a peer of France in 1833, and eventually Chancellor of the University of Paris.

101 Louis-Antoine Cordier (1777–1862) began as a mining engineer; participated, under Déodat-Guy-S. Tancrède de Dolomieu (1750–1801), in Napoleon's scientific corps on the Egyptian expedition; worked at the École des Mines for a while and was in 1819 appointed Professor of Geology at the Jardin des Plantes.

102 Francis Rawdon, First Marquis of Hastings (1754–1826) [whose earlier title was Earl of Moira], Governor-General of Bengal from 1812 to 1821.

103 Presumably again from Warwickshire.

104 Georges Cuvier.

105 William Daniel Conybeare.

106 Presumably for family reasons: see p. 249.

107 This was maintained by the Royal College of Surgeons and, although badly bombed in the Second World War, still survives.

108 'Description of the Quartz Rock of the Lickey Hill in Worcestershire, and of the Strata immediately surrounding it.' *Trans geol. Soc. Lond.* **5**, 1821: 506–544.

109 H. T. De la Beche and W. D. Conybeare, 'Notice of the discovery of a new fossil animal [*Plesiosaurus*] forming a link between the *Ichthyosaurus* and crocodile, together with general remarks on the osteology of the *Ichthyosaurus.*' *Trans. geol. Soc. Lond.* **5**, 1821: 559–594. The discussion which follows concerns *Ichthyosaurus.*

110 William Daniel Conybeare.

111 Northern, or Steller's Sea Lion (now *Eumetopias jubatus* [Schreber]).

112 Northern, or Alaska Fur Seal (now *Callorhinus ursinus* [Linn.])'

113 Henry, 3rd Earl of Bathurst (1762–1834), distinguished politician. Secretary for War in Lord Liverpool's government and friend of the Duke of Wellington. Presented a collection of stuffed animals from Madagascar to the Bristol Philosophical and Literary Society in 1825.

114 Conybeare then lived at Brislington, Somerset, a few miles southwest of Bristol.

115 Not identified.

116 John Wilson Croker (1780–1857), politician and essayist; then M.P. for Bodmin (1820–26). Friend of Peel.

117 Charles Ricketts, who may have been a son of George William Ricketts and brother of the distinguished Indian civil servant Sir Henry Ricketts (1802–1886).

118 William Daniel Conybeare.

119 'On the peculiarities which distinguish the Manatee of the West Indies from the Dugong of the East Indian seas.' *Phil. Trans. Roy. Soc. Lond.* **111**, 1821: 390–391.

120 *A critical examination of the first principles of Geology.* (London: Longman) 1819.

121 Switzerland.

122 See note 96.

123 Adolphe Brongniart (1801–1876), son of Alexandre, destined to become the greatest figure in palaeobotany in the nineteenth century.

124 Deer.

125 Constant Prévost (1787–1856), later a founder of the Société Géologique de France and three times its President, principally remembered for his theories in dynamic geology, who published at this time the first account of the geology of the Vienna basin. Prévost was later to secure a skeleton of *Plesiosaurus dolichocherius* from Mary Anning of Lyme Regis, for the Musée d'Histoire Naturelle in Paris: the specimen was figures in Cuvier's *Ossemens fossiles*, 1836 edition, *Atlas*, pl. 3.

126 Anselme Gaétan Desmarest (1784–1838), French naturalist and lexicographer. The note referred to may be his entry on 'Trilobites' in the *Nouveau Dictionnaire d'Histoire Naturelle*, second edn., vol. THE–TSU, pp. 449–50.

127 Frederick William Hope (1797–1862), author of some 60 papers on entomology and President of the Entomological Society in 1835 and 1846.

128 Davies Giddy [afterwards Gilbert] (1767–1839), an early member of the Geological Society of London and first President of the Royal Geological Society of Cornwall. The first alternative cited by Pentland was correct, since Giddy changed his name (doubtless for reasons of respectability) in 1817!

129 Philip Barker Webb (1793–1854), a botanist who became interested in geology through Buckland's teaching and who was to be Secretary to the Geological Society of London in 1824–25.

130 Not identified.

131 Revd. Prof. John Stevens Henslow (1796–1861), an all-round naturalist who was shortly afterwards (1823) appointed Professor of Mineralogy at Oxford, holding this post till 1827, when he became Professor of Botany. Remembered especially for his friendship with, and influence on, Charles Darwin.

132 Adam Sedgwick (1785–1873), appointed Woodwardian Professor of Geology at Cambridge in 1818 on the basis of no experience whatsoever, was nonetheless destined to become one of the greatest nineteenth-century geologists.

133 Sedgwick's two earliest publications both concerned Cornwall. The one most likely to have reached Pentland at this date is 'On the Physical Structure of those formations which are immediately associated with the Primitive Ridge of Devon and Cornwall', *Trans. phil. Soc. Camb.* **1** 1820: 89–146.

134 But compare Pentland's earlier comment, inadequately deleted, in his letter of 21 June 1821 (p. 278)!

135 William Daniel Conybeare.

136 George Brettingham Sowerby (1788–1854), son of the famous naturalist James Sowerby (1757–1822) and author of 'On the geological formations of Headon Hill in the Isle of Wight', *Ann. Phil.* (N.S.) **2** 1821: 216–220, in which Webster's ideas are sharply criticised.

137 For a discussion of this matter, and of Underwood's role in it, see J. Challinor, 'Some correspondence of Thomas Webster, geologist (1773–1844) – – I'. *Ann. Sci.* **17**, 1961: 175–195.

138 Georges Cuvier.

139 Alfred Duvaucel: see notes 34–36.

140 Duvaucel and Diard.

141 See note 102. The Marquis of Hastings had in fact already resigned his appointment as Governor-General of Bengal (though he did not in fact leave India till January 1823), so that it is questionable whether he could have been of any service to Pentland.

142 Selina Frances Rawdon (1759–1827) became by marriage Countess of Granard.

143 Robert Brown (1773–1858), naturalist on Capt. Mathew Flinder's expedition to Australia in 1801–5, librarian to Sir Joseph Banks and Keeper of Botany at the British Museum (1827–1858).

144 Jacques-Julian-Houtou de Labillardière (1755–1834), botanist on D'Entrecasteaux' expedition in search of La Pérouse. Author of *Novae hollandiae plantarum specimen* (published in 27 parts, 1804–1807).

145 Paul Gaimard (1790–1858), naturalist on the Freycinet expedition of 1818–1820.

146 Thomas Pennant (1726–1798), distinguished English naturalist and traveller.

147 George Shaw (1751–1813) of Magdalen Hall, a founder member of the Linnean Society of London. Assistant Keeper of the Natural History Department of the British Museum, 1791–1807, Keeper from 1807 till his death. (See also p. 290).

148 John Latham (1740–1837), ornithologist; author of *A General Synopsis of Birds* (3 vols., 1781–5), *Index Ornithologicus sine Systema Ornithologiae* (2 vols., 1790) and of other major works published after the date of this letter.

149 Sir Humphry Davy was at this time President of the Royal Society, to which office he had succeeded on the death of Banks.

150 Karl Dietrich Eberhart König [later known as Charles Konig] (1774–1851) succeeded Shaw as Assistant Keeper of Natural History at the British Museum and as Keeper on the latter's death in 1813. In 1837, when his office was divided, he became Keeper of the Mineralogical and Geological Branch, which appointment he held till his death.

151 Possibly Louis-Etienne-Francois Héricart, Vicomte de Thury (1776–1854), French anatomist, historian and geologist.

152 From Kirkdale Cave, near Kirby Moorside, northeast Yorkshire. Buckland first visited this cave on 26 November 1821 (see P. J. Boylan, 'Dean William Buckland 1784–1856. A pioneer in Cave Science.' *Studies in Speleology* **1** 1967: 237–253). The first published account of the cave was Rev. G. Young 'On the fossil remains of quadrupeds, &c., discovered in the Cavern of Kirkdale . . . *Mem. Wernerian nat. Hist. Soc.* **4** 1822: 262–270. Buckland himself addressed the Royal Society on the Kirkdale discoveries in February 1822 (see *Phil. Trans. R. Soc., Lond.* **122**: 171–236) and conducted Sir Humphry Davy on a visit to this cavern and nearby caves in July 1822.

153 Name not traced; perhaps an unpublished manuscript name formulated by Cuvier, probably for the Woolly Rhinoceros (*Coelodonta antiquitatis*), which Cuvier called *Rhinoceros tichorhinus*.

154 The Sumatran Rhinoceros (*Didermocerus sumatrensis*).

155 The Wolverine or Glutton (*Gulogula*).

156 Buckland visited these German caves in the summer of 1882 (See Boylan, note 152, 1967, p. 242).

157 Johann Christian Rosenmüller (1771–1820), anatomist at Leipzig and author of *De Ossibus fossilibus animalis* (1799).

158 A puzzling comment, since according to his obituary notices Pentland had been early left an orphan. Foster-parents, perhaps?

159 Granville Levenson-Gower, first Earl Granville (1773–1846), diplomat and intimate friend of Canning.

160 This letter is not among Davy's surviving correspondence, nor is a copy of it among Cuvier's surviving letters.

161 John Frederick Müller or Miller, son of a distinguished German draughtsman, Johann Sebastian Müller [also known as John Miller] (1715?–1790?), who settled in England in 1744. His son also worked for a while as a draughtsman, accompanying in this capacity Banks and Solander when they visited Iceland in 1773, and later published a series of notes on natural history.

162 Thomas Horsfield (1773–1859), an American who worked under Raffles' direction on the natural history of Java and was, from 1820 until his death, Keeper of the Museum of the Honorable East India Company. Worked especially on birds.

163 Alcide Dessalines d'Orbigny (1802–1857), zoologist and palaeontologist, destined to become one of the most distinguished stratigraphers of the 19th Century; he formulated the concepts of zones and stages in international stratigraphic correlation.

164 Not identified.

165 Buckland was elected in 1821 Corresponding Member of the Muséum d'Historie Naturalle au Jardin du Roi.

166 J. S. Miller's *Natural History of the Crinoidea* (Bristol, 1821).

167 Correctly *Gryphaea arcuata* Lamarck (of which *G. incurva* J. Sowerby is an invalid junior synonym).

168 Jean-Baptiste-Pierre-Antoine de Monet, Chevalier de Lamarck (1744–1829), Professor of Zoology at the Jardin du Roi and thus a colleague of Cuvier; famed for his 'transformist' evolutionary theory and for his work on the classification of living and fossil invertebrates.

169 One of twelve species of this genus distinguished by Lamarck in his *Histoire naturelle des animaux sans vertébrés* (1819).

170 From 1753 to 1963, the British Museum was governed by a Board of Trustees, headed by three Principal Trustees—the Archbishop of Canterbury, the Lord Chancellor, and the Speaker of the House of Commons. The Archbishop was the most senior of the three Principal Trustees and Pentland's memorial would thus have been addressed to him.

171 His Grace the Archbishop of Canterbury.

172 Presumably Pentland meant that Home's work was deteriorating; there were no events in Home's life at this time to account for any other interpretation, nor was there any cessation in the flow of papers from his pen.

173 William Swainson (1789–1855) travelled and collected in South America before 1820; on return, he unsuccessfully sought appointment at the British Museum and, after failing to gain it, became a prolific author of zoological works for Longman, Orme, Brown & Co. Emigrated to New Zealand in 1835 and died there. Notorious for his formulation of the "Circular Classification' of animals.

174 See note 77. "Stevens was Treasurer of the Entomological Society—a most active collector, but known as an author only of notes in The Zoologist and Entom Soc. Tr." (*An Accentuated List of the British Lepidoptera*, 1858.)

175 See note 147. For a description of the British Museum collections in Shaw's time, see J. M. Sweet 'Robert Jameson in London, 1793', *Ann. Sci.* **19** 1963: 81–116.

176 Peter Simon Pallas (1741–1811), German naturalist who travelled extensively in eastern Russia and Siberia and who published vast volumes of observations in geography, geology, botany, zoology and ethnography.

177 This paragraph, and especially its last sentence, assuredly destroyed beyond redemption any remaining hope Pentland may have had of Buckland's support. As it transpired, however, none of the candidates named in these letters succeeded to the vacancy left by Leach's retirement. The appointment was not filled till 1823, when John George Children (1777–1852) was transferred to this post from the Dept. of Antiquities—doubtless to the profound dismay of Pentland, Buckland *et al.*! When the Keepership was divided in 1837, Children was promoted to be Keeper of the Zoological Branch, retiring from this post in 1840.

178 Transl. 'he is, of all those I know, the one who possesses best the principal branches of zoology.'

179 Transl. 'is an almost sure means of your catching up in a field in which we have hitherto surpassed you.'

180 Perhaps the drawing of the Honfleur crocodile bones, requested in Pentland's earlier letter (p. 283).

181 Buckland's reply had clearly brought home to Pentland the tactlessness of his earlier letter (see note 177).

182 P. J. Boyland, in his account of Buckland's work at Kirkdale (note 152), noted that Buckland had been working at Kirkdale Cave in December 1821 and presumed that the visit begun on 26 November had lasted more than a week. Pentland's letter makes it clear, however, that Buckland paid a *second* visit to the cave within a month of his first, which must have been brief.

183 'On Mr Conybeare's behalf' is intended.

184 Presumably a reference to Buckland's projected visit to Yorkshire.

185 Robert Banks Jenkinson, 2nd Earl of Liverpool (1770–1848) was Prime Minister from 1812 to 1827 and also served as Leader of the House of Lords.

186 Charles Ricketts: see note 117.

187 Sir Walter Calverley Trevelyan, F.G.S. (1797–1879), a keen naturalist who had brought Buckland fossil plants from his father's property near Newbiggin, Northumberland, in 1815. Trevelyan went to the Faeroes in 1821, but not to Spitzbergen. Webb, although a great traveller, does not seem to have accompanied him or, indeed, to have ever travelled in northern seas.

188 Piacenza.

189 *Histoire naturalle des Crustacées fossiles sur les rapports zoologiques et géologiques, savoir les Trilobites*. Paris, 1822.

190 Not further identified.

191 Probably Royer-Collard; of a notable French family of savants. The most probable are either Pierre-Paul Royer-Collard (1763–1845), distinguished French philosopher, or his brother's son Hippolyte-Louis Royer-Collard (1802-1850), who became a doctor of medicine but may have taken anatomy courses from Cuvier and worked for him.

192 *Mémoires sur les Animaux sans vertèbres* (1816) by Marie-Jules-César Savigny (1777–1851), a French naturalist who ultimately went blind through too much microscope work.

193 Not identified.

194 The Woolly Rhinoceros, *Coelodonta antiquitatis* Blumenbach (≡*Rhinoceros tichorhinus* Cuvier).

195 This jaw, referred by Cuvier (*Ossemens fossiles*, 1824, vol. 5, p. 349) to *Didelphys*, was found in the Great Oolite at Stonesfield. It was later used as holotype for the species *Amphitherium prevosti* Owen.

196 Probably the jaws of the marine reptile found at Market Rasen, lodged in the collections of Oxford University Museum (present catalogue nos. J.9245 a–b), to which Conybeare assigned the name *Plesiosaurus giganteus* (*Trans. geol. Soc. Lond.*, (2) **1** 1824: 389) without giving any definition, and which subsequently became the type of *Pliosaurus brachydeirus* Owen (*Rep. Br. Ass. Advmt. Sci.* **1841** 1842: 61).

197 The Rev. George Young (1777–1848), a Scot who was for 42 years pastor of Cliff Lane Chapel, Whitby, Yorks. and published extensive studies on the geology and history of Yorkshire.

198 G. Young and J. Bird, 1822, *A geological survey of the Yorkshire coast*. (Whitby; Clark) iv + 236pp., which contained 17 hand-coloured plates.

199 Not identified.

200 The Spotted Hyena (*Crocuta crocuta*).

201 The Striped Hyena (*Hyaena hyaena*).

202 Conrad Jacob Temminck (1778–1857), Dutch ornithologist, Curator of the Royal Museum at Leiden, Netherlands, and later the employer of Diard.

203 Louis-Nicolas Vauquelin (1763–1829), distinguished French chemist and mineralogist; the discoverer of chromium and boron.

204 William Hyde Wollaston (1766–1828), distinguished British scientific polymath: pioneer of the study of powder metallurgy.

205 Schaffhausen.

206 'Account of an Assemblage of Fossil Teeth and Bones of elephant, rhinoceros, hippopotamus, bear, tiger, hyena and sixteen other animals, discovered in a cave at Kirkdale, Yorkshire, in the year 1821'. *Phil. Trans. Roy. Soc., Lond.*, **122** 1822: 171–236. For a modern assessment of Buckland's studies of cave fauna, see P. J. Boylan, 1967 (note 152).

207 Neither of these gentlemen has been identified.

208 Not further identified.

209 Filippo Nesti (dates uncertain), then one of Italy's leading palaeontologists, who had written a series of papers on the mammalian fossils of the Val d'Arno.

210 Of Tuscany.

211 Joseph-Jérome le Français de Lalande (1732–1807), distinguished French astronomer, whose *Voyages d'un Français en Italie en* 1765–66 (Venice and Paris, 1769, 8 vols. in 12 atlas) includes a volume on natural history.

212 See *Nuovo Giorn. Letterati*, vol.11, *Parte Sci.*, pp. 195–216; the mastodon fossil is figured in his pl. i.

213 Giovanni Targioni-Tozzetti (1712–1783), naturalist of Tuscanny especially interested in fossil elephants.

214 Luigi Canali, then Curator of the Museum at Perugia, who had written an account of Italian fossil elephants in 1810.

215 Figline Valdarno, some 10–11 miles S.E. of Florence in the upper Arno Valley (43° 37′N, 11° 28′E).

216 Not identified.

217 For a discussion of the significance of this skull, see p. 249.

218 The Manatee (*Trichechus*).

219 May be a place-name or personal name; not clear from context.

220 Obsolete name for Leghorn, port on the coast S. of the Arno estuary.

221 'Notice on the Megalosaurus, or Great Fossil Lizard of Stonesfield.' *Trans. geol. Soc. Lond.* (2) **1** 1824: 390–396.

222 Not identified.

223 *Reliquiae Diluvianae; or, Observations on Organic Remains Attesting to the Action of an Universal Deluge.* London. (1st edn. 1823). Pentland's use of the word 'new' is curious: perhaps he considered as first edition Buckland's earlier *Vindiciae Geologicae* (Oxford, 1820), which was indeed a sort of forerunner of the later work, but it is equally possible that Pentland may have been referring to a projected second volume of the *Reliquiae*, for which Buckland was unquestionably preparing at that time. In the *Reliquiae diluvianae* (pp. 26, 101, 149–150) Buckland quoted, and ascribed to Pentland, a great deal of data on Italian fossil mammals and on the Val d'Arno, in part duplicating the details given in this letter to Cuvier; clearly, therefore, their correspondence continued for some time after the last letter here transcribed, but none of these later letters has been located by us.

224 Pentland certainly did not present this collection to the British Museum, nor does he seem to have presented it to the Geological Society of London.

225 Almost certainly Mrs S[arah] Lee. Mrs Lee was earlier the wife of T. Edward Bowditch, who, after earlier travels in Africa, spent four years (commencing in 1819) studying in Cuvier's library and collection in preparation for a second African journey, during which he died. His wife remained a close friend of the Cuviers and was [ultimately] the author of *Memoirs of Baron Cuvier* (New York & London: Harper 1833, 197 pp.).

226 Presumably G. B. Brocchi's *Conchologia Fossile Subapennina* (2 vols., 1814) which Pentland may well have obtained from Italy for Christie.

227 Despite this pessimistic comment the Société Géologique de France, to which Pentland is unquestionably referring, was a healthy infant and flourishes to this day!

228 Jane Franklin, née Griffin (1792–1875), Franklin's second wife, whom he married in 1828 and who later became famous for her efforts to stimulate searches for her lost husband.

229 Edmé-François Jomard (1777–?), distinguished French archaeologist and geographer.

230 George Samuel Perrottet (1793–1870), an English botanist who certainly travelled extensively in Asia, Africa and the Caribbean and may well have visited South America. Specimens from his collection survive in the herbarium of the British Museum (Natural History).

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